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OPERATIONAL RESEARCH DIVISION

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RESEARCH AND DEVELOPMENT BRANCH

COMMAND AND CONTROL WORKSHOP: STRUCTURES AND PROCESSES FOR R&D SERVICE DELIVERY

by

Ivan Taylor
Dr. G.W. Frank

DECEMBER 1996

OTTAWA, CANADA

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CANADA

OPERATIONAL RESEARCH DIVISION

DIRECTORATE OF OPERATIONAL RESEARCH (JOINT & LAND)

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ABSTRACT

On 7-9 May 1996, the Chief of Research and Development (CRAD) held a Workshop on Command and Control (C2) which brought together CRAD scientists and Canadian Forces (CF) Officers to discuss the "what" and the "how" of C2 Research and Development (R&D). The participants were divided into syndicates to discuss these issues using a structured brainstorming technique developed by the authors. This paper documents the results of the brainstorming exercise on the structures and processes (the "how") suggested for future C2 R&D. A companion paper is available on the requirements and opportunities (the "what") for C2 R&D for the foreseeable future.

There was a large amount of consensus on the main findings of this syndicate exercise which were that: a team culture must be established to provide the synergy necessary to exploit these new technologies quickly and effectively; the process of information dissemination and internal communication must be improved to enhance the capabilities of the teams; the future Battle Labs should be exploited to their fullest to provide an experimental environment for C2 R&D; and the organization and structures will need to be improved to streamline the R&D process. Some other ideas were presented without full consensus, such as: the establishment of an evolutionary R&D and Procurement paradigm; the need for a new strategic direction in C2 R&D which should be developed by CRAD and CF leadership; and business planning and accountability which will improve the relationship between CRAD and its sponsors making the R&D process more responsive. The conclusion of this workshop was that the team approach to C2 R&D has begun and that there is much more work to do to exploit the many good ideas provided by the workshop attendees and documented in the Annexes to this paper.

RESUME

Le CR Dév a tenu un atelier sur le commandement et contrôle du 7 au 9 mai 1996 dont le but était de réunir scientifiques du CRDév et officiers des Forces canadiennes pour discuter des besoins et des moyens en matière de R&D pour le commandement et contrôle. Regroupés en deux ateliers, les participants firent appel à une technique de conférence d'idées mise au point par les auteurs. Ce rapport fait état des résultats de la conférence quant au cadre et au processus suggérés pour la mise en oeuvre du système intégré de commandement et contrôle (ISCC). Les besoins et possibilités de recherche à court et moyen termes sont décrits dans un document faisant pendant à ce rapport.

Lors des ateliers, un fort consensus s'est dégagé sur les points suivants: afin de rendre les chercheurs plus efficaces, on devra encourager le travail d'équipe, miser sur les effets de synergie et améliorer la dissémination de l'information et les communications internes. Afin d'offrir un milieu expérimental en commandement et contrôle, les futurs laboratoires de combat devront être exploités au maximum; et les améliorations organisationnelles et structurelles seront axées sur la simplification des méthodes de R&D. Certaines idées ne faisant pas consensus furent toutefois présentées telles l'adoption d'un processus évolutif pour la R&D et l'acquisition d'équipement; la nécessité, pour le CR Dév et les Etats-majors, d'amorcer un virage stratégique; et la mise en place de plans d'affaire et de principes d'imputabilité de nature à favoriser les relations du CR Dév avec sa clientèle . La conclusion d'ensemble de l'atelier fut que l'approche d'équipe est déjà en marche et que les idées proposées par les participants et documentées dans les annexes demeurent une tâche très exigeante.

EXECUTIVE SUMMARY

The Chief of Research and Development (CRAD) directed that a high level study be conducted into Command and Control Research and Development (C2 R&D) in the Department of National Defence (DND). As part of this study, a workshop was organized to bring together Canadian Forces (CF) Officers and CRAD scientists to discuss the "what" and the "how" of C2 R&D. This paper discusses the structures and processes with which to carry out C2 R&D (the "how"). A companion paper discusses the requirements and opportunities in C2 R&D (the "what").

The workshop was held 7-9 May 96 and was organized around syndicates. After getting direction from Deputy Chief of Defence Staff (DCDS) and CRAD as well as a panel of senior officers and managers, the workshop broke up into six syndicates to discuss the requirements and opportunities for C2 R&D in the areas of human factors, analytical methods, and information systems. After a plenary session in which the results of this first syndicate were discussed, the workshop broke up into new syndicates to discuss the structures and processes for C2 R&D.

The syndicate process was based on a structured brainstorming technique developed by the Operational Research Division. It involved three stages: idea generation using the Nominal Group Technique; idea development using the Idea Writing Technique along with de Bono's Thinking Hats structure; and finally an anonymous vote and tally for prioritization and closure. Using this methodology hundreds of raw ideas were generated and hundreds of pages of idea development were written. All of these are recorded in the Annexes to this paper for the use of the C2 R&D Task Force in their development of a strategic plan.

In the structures and processes syndicates, consensus on four broad concepts emerged: establishment of a team culture; improved information dissemination and internal communication; exploitation of Battle Labs; and streamlining of organization and structures in the R&D process. Also three concepts surfaced without complete consensus: business planning and accountability; need for a new strategic direction; and establishment of an evolutionary R&D and procurement paradigm.

By establishing a team culture, it was hoped that there would be synergy enough to multiply the available resources and thereby exploit the potential of the new technologies coming into existence. There were 73 ideas generated under this heading by the four syndicates.

Improving the dissemination of information and internal communication will be necessary if these new teams are to work effectively. These teams may represent a virtual organization that is geographical dispersed but functionally interdependent. This concept involved 66 ideas.

The exploitation of Battle Labs will allow for the effective test and evaluation of new or prototype systems as well as the potential to evaluate the performance of existing person-machine systems. There were 32 ideas under this heading.

Improving the organization and structure of R&D was not intended to be a call for re-engineering. Instead it was more the intention to develop a process of continuous improvement and establish centres of excellence. There were 52 ideas generated in this area.

The need for an evolutionary R&D and procurement paradigm recognizes the fact that the C2 technology is changing very quickly, often more so quickly the procurement system cannot keep up. The idea of "proto-cycling" may be adaptable to this environment. The syndicates had 29 ideas of how this might be established.

The need for a new strategic direction was identified by two syndicates who generated 19 ideas in this area. Although this is a difficult problem for leadership with the rapid pace of technology, it was recognized that plans may be useless but planning is essential.

Business planning and accountability were raised by two syndicates and they generated 42 ideas. It was envisioned that the R&D process would become more responsive and the operational staffs more forward-looking, if the R&D business plan was incorporated in the business plans of the operational staffs they support.

These represent just a few of the ideas generated during the Workshop. There are many others identified and described in the Annexes. It is now up to the C2 R&D Task Force to evaluate these ideas and determine which should be pursued. The development of a new structure and new processes with which to carry out the research requirements and opportunities of C2 R&D is the ultimate goal of the leadership of CRAD, the CF and DND.

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CRAD COMMAND AND CONTROL WORKSHOP: STRUCTURES AND PROCESSES FOR R&D SERVICE DELIVERY

BACKGROUND

1. The Chief of Research and Development (CRAD) directed that a high level study be conducted into Command and Control Research and Development (C2 R&D) in the Department of National Defence (DND) (Ref. 1). As part of this study, a workshop was organized to bring together Canadian Forces (CF) Officers and CRAD scientists to discuss the "what" and the "how" of C2 R&D. Approximately, 30 scientists and 30 officers were divided equally into six syndicates which worked for two days to develop the ideas from which a strategy for C2 R&D could be developed by CRAD in conjunction with the leaders of the CF and DND. The following paper discusses the results of the second day of deliberations, on the structures and processes for C2 R&D service delivery (the "how"). A companion paper discusses the requirements and opportunities for C2 R&D (the "what") (Ref. 2).

2. The Workshop was organized around the syndicates. It began with a plenary session in which the Deputy Chief of Defence Staff (DCDS) and CRAD gave prepared speeches providing direction to the attendees. This was followed by presentations from a panel of senior officers and civilian managers which provided additional direction. The Workshop then broke into six syndicates to discuss the requirements and opportunities for C2 R&D in the areas of human factors, analytical methods and information systems. When the Workshop reconvened the next day, the syndicate facilitators presented their findings to the plenary session. The Workshop then reorganized into new syndicates to discuss the structures and processes required to deliver this C2 R&D. On the morning of the final day, the panel of senior officers and managers reconvened to hear summary presentations of the previous days' syndicate results.

THE QUESTION

3. The syndicate process was focused around a question. In the second syndicate, all of the groups were asked the following question:

> "What structures and processes should be put in place to establish a team approach to C2 R&D in the department that will meet the current and future needs of the CF?"

There was some discussion about this question in the plenary session and it was decided that the participants should consider this an opportunity to visualize the ideal environment for conducting C2 R&D in the future. Implicit in the question is the assumption that the current structure and processes are not working effectively in the rapidly changing environment of information technology. It is also assumed that a team approach which includes operators and developers can provide the synergy necessary to exploit these new technologies.

THE SYNDICATE PROCESS

4. A structured brainstorming approach (Refs. 3 and 4) was used in the syndicate deliberations to maximize the effectiveness and efficiency of the process. This process was conducted in three stages with multiple sub-stages:

a. the idea generation stage:

(1) discussion of the problem statement to obtain focus;

(2) silent writing of raw ideas;

(3) round-robin collection of raw ideas; and

(4) grouping of ideas around concepts;

b. the concept development stage;

(1) prerequisites in terms of information needs;

(2) how-to's in terms of creative implementation approaches;

(3) benefits of progressing this initiative;

(4) possible negative side-effects or potential problems with implementation; and

(5) bottom-line unsubstantiated "gut feeling" about the concept; and

c. anonymous vote for prioritization, with a discussion of voting results.

5. This process was developed to improve productivity and encourage creativity in group discussions. It was intended to get a lot of work done in the time available and yet be egalitarian and non-confrontational. It attempted to drive to a consensus in the group yet allow for dissenting opinions in the anonymous vote, thus avoiding "group think". It was intended to be self-documenting. It used low-technology equipment and was therefore inexpensive to conduct. It was structured so that it was nearly facilitator free. So training of the facilitators was not time-consuming or expensive.

6. The process generated hundreds of raw ideas which were suggested by the participants in good faith to potentially improve the organization. During the concept development process, over one hundred pages of notes were generated. All of this detailed information is provided in the Annexes to this report. Unfortunately, when the presentation to the panel was provided, there was insufficient time to do a complete analysis of the detailed information. It is hoped that the C2 Task Force will have time to evaluate the material in full detail in time to complete their report. The following discussion of the findings of the syndicates represents a quantitative assessment of the results. In this regard, we have attempted to identify areas of consensus among the syndicates' concepts. We will not provide very much in the way of concept development; for that we refer the interested reader to the annexes.

THE RESULTS

7. As previously mentioned, the second syndicate session at the C2 Workshop involved 60 people divided into six syndicates. It generated 234 specific ideas under 32 concepts. The

concept development process generated 144 pages of hand-written notes; all of which are documented in the annexes. Table I summarises these seven concepts.

TABLE I

PRINCIPAL C2 R&D CONCEPTS IDENTIFIED IN SYNDICATE

Concept	No. Teams Assigning Concept High Priority (max = 6)	Average Ranking	Number of ideas generated
Establish Team Culture	4	2.3	73
Improve Communication and Information Dissemination	4	4.0	66
Exploit Battle Labs	3	2.3	32
Improve Organization and Structure	3	3.0	52
Establish Evolutionary R&D and Procurement Paradigm	2	1.5	29
Strategic Direction	2	2.0	19
Business Planning and Accountability	2	3.5	42

Establish Team Culture

8. This concept was actually stated in the question. Therefore it was not surprising to find that four of the six syndicates identified it as a high priority concept. In fact, the average rank of this concept was 2.3 which means that most of the groups rated it very high on their list. There were 73 individual ideas listed by the syndicates under this concept.

9. The question of who would comprise the team was brought up by the panel. It was suggested that teams are in general small and focused. However, the team membership should be considered broadly as long as each member is contributing effectively to the team's goal.

Improve Communication and Information Dissemination

10. Four groups out of six recognized this problem as a concept for development. It was given lower priority with an average rank of 4.0. Sixty-six specific ideas were generated under this heading.

11. It was felt that this problem has been discussed for many years without much in the way of concrete results forthcoming. If the team approach can be established then much of the communication problem might be alleviated. However, with the constant turnover of military officers, the communication process will need to be constantly examined to ensure it is meeting the needs of the system.

Exploit Battle Labs

12. Three groups identified Battle Labs as a separate concept but many of the syndicates had Battle Labs among their individual ideas. The average rank for this concept was fairly high at 2.3 and there were 52 ideas listed under it.

Improve Organization and Structure

13. Three groups identified the need to improve the organization and structure of C2 R&D. The average rank was 3.0 which suggests that this concept was given medium priority. However, there were 52 ideas suggested to improve the C2 R&D organization and structure.

14. This was not a call for re-engineering. However, it did overlap with the first two concepts of team building and improving communication.

Establish Evolutionary R&D and Procurement Paradigm

15. This was identified as an individual concept by two groups with an average rank of 1.5. The two groups that identified this concept listed 29 ideas under this heading. The basic premise here is to integrate R&D into the Procurement process to speed up development and reduce risk. Separating R&D, Procurement and O&M is no longer viable in C2 because of the rapid pace of technology which makes new equipment obsolete in months rather than years.

Strategic Direction

16. Two groups identified strategic direction as lacking in C2 R&D. They gave this concept a high rank of 2.0 and listed 19 ideas under this heading. The authors noted that strategic planning has been very difficult in recent years because of rapidly changing technology.[1]

Business Planning and Accountability

17. Three groups mentioned this concept and gave it an average rank of 3.5 which indicates a middle priority. There were 55 ideas generated under this heading. The intent of this concept was to bring the operator and the research team closer together by including R&D under the business plan of the user. One group suggested that R&D could be corporately managed in a business sense as a risk portfolio. The current system which has a separate business plan for R&D independent of the operational users of the R&D was considered inefficient.

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[1] The potential and the limitations of strategic planning is extensively discussed in Henry Mintzberg's recent book "The Rise and Fall of Strategic Planning" (Ref. 5).

CONCLUDING REMARKS

18. The annexes provide the detailed results of each of the syndicates. The reader will find the concepts and their development a "gold mine" of worthwhile suggestions for process improvement. Many of the ideas unfortunately are not fully developed. There are specific techniques for "harvesting" ideas that could be useful to the C2 R&D Task Force (see Ref. 6). There are other ideas which may need to "moulded" to fit within the constraints of the current situation. The techniques in Reference 6 may be helpful here also. However, none of the ideas should be ignored. They were provided in good faith and although not fully explained at present could be developed into process improvements in the future. The goal of this report is to provide an archive for all of the ideas generated during this workshop.

19. The participants almost unanimously felt that this exercise was worthwhile. They enjoyed the process and were happy to have an opportunity to contribute to the improvement of this important area of R&D. The organizers considered the workshop to be a success because the process of developing a team approach to C2 R&D service delivery was begun. A great deal of work is still required. However, with the numerous ideas presented in the workshop and recorded in this report, the C2 R&D Task Force has a great deal of material with which to build a new strategy for C2 R&D service delivery.

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3. Taylor, Ivan; "The Nominal Group and Idea Writing Techniques for Structured Brainstorming"; D Log A Research Note 95/3; May 1995.

4. Taylor, Ivan; "An Extension to Structured Brainstorming Using the Six Thinking Hats", April 1996, D Log A Research Note 9603, April 1996.

5. Mintzberg, Henry; "The Rise and Fall of Strategic Planning"; Prentice-Hall; New York; 1994.

6. De Bono, Edward; "Serious Creativity"; Harper Collins Publishers; 1992.

SYNDICATE 2A: PROCESSES AND STRUCTURES

INTRODUCTION

A-1. Session 2 consisted of all six syndicate groups examining the same question:

"What structures and processes should be put in place to establish a team approach to C2 R&D in the department that will meet the current and future needs of the CF?"

Syndicate 2A developed 45 ideas which were grouped into the following five concepts:

a. Structure/Organization;

b. Co-ordination and Communications;

c. Mechanisms for Experimentation, Fielding, Training, Testing and Evaluation;

d. Team Culture; and

e. External Influences (external to R&D).

A-2. The following format is used in documentation. For each concept:

a. Idea base for each concept (generated via the Nominal Group Technique);

b. Idea development for each concept (generated via Ideawriting and the Six Thinking Hats):

(1) Information needs;

(2) Creative solutions;

(3) Benefits;

(4) Problems; and

(5) Gut feelings;

c. Prioritization (syndicate member votes):

a. Voting summary (anonymous vote matrix); and

b. Consensus Decision Support Program (CDSP) computer program analysis.

A-3. Voting results did not appear to indicate group consensus. The average ranking of concepts did not indicate a strong preference for priority. The data was also analyzed using a computer-based consensus analysis program. A statistically significant degree of consensus was *not* found in the votes recorded for this syndicate group.

IDEA INVENTORY

1. Large enough Centres of Excellence for critical mass.
2. Military presence in labs.
3. Common team model.
4. Assesses areas of most impact (including industry).
5. Fast turnover.
6. Small co-ordinating committee.
7. Bottom-up process (define requirements).
8. Modular architecture (allies), COTS.
9. Better integration with industry.
10. Joint/team workshops.
11. Real-time communication between team members.
12. Permits R&D to be integrated into the final system without re-doing it.
13. Top-down direction.

14. Focus/ niche specialization.
15. Checks and balances.
16. Formalization of activities and responsibilities.
17. Link test and evaluation to R&D.
18. Increase military awareness on the part of scientists.
19. Focus on joint/combined ops.
20. Flexible reallocation of resources.
21. Process has to include training.
22. Flat command structure.
23. Overseeing body with final decision power.
24. Staged fielding.
25. Commitment to actually procure once R&D is done.
26. Military input in prioritization of R&D.
27. No padding of team just to have a group represented.
28. Feedback mechanism to show progress and effectiveness (or lack thereof).
29. Base product must be clearly defined.
30. Long-term commitment of/by personnel.
31. Streamlined acquisition.
32. Maintain international contacts.
33. Availability of experimental test facilities with humans in the loop.
34. Evolutionary development.
35. Adequate resources up front.
36. Scientific adoption of common core of services.
37. Time and money commitment up front.
38. Opportunities for players to see what ultimate participation opportunities may be.
39. Promote dialogue for honest communication of information.
40. Battle lab testing.
41. Get rid of rank consciousness.
42. Constant interchange between team members.
43. Mechanism for co-ordination.
44. Discussion and consensus building.
45. Informal contact within formal structures.

CONCEPT A: STRUCTURE/ORGANIZATION

Idea Base

1. Large enough Centres of Excellence for critical mass.
2. Military presence in labs.
5. Fast turnover.
6. Small co-ordinating committee.
7. Bottom-up process (define requirements).

9. Better integration with industry.
12. Permits R&D to be integrated into the final system without re-doing it.
13. Top-down direction.
14. Focus/ niche specialization.
15. Checks and balances.
16. Formalization of activities and responsibilities.
17. Link test and evaluation to R&D.
21. Process has to include training.
22. Flat command structure.
23. Overseeing body with final decision power.
25. Commitment to actually procure once R&D is done.
26. Military input in prioritization of R&D.
27. No padding of team just to have a group represented.
30. Long-term commitment of/by personnel.
33. Availability of experimental test facilities with humans in the loop.
45. Informal contact within formal structures.

Structure/Organization: Information Requirements

1. Availability (level) of funding - leads to size of organization
2. Industry participation / university
3. Availability of personnel
4. Industrial structures
5. Flexible organization required
6. Most of organization core should be in a single location
7. Require experts from all areas
8. Need centres of excellence
9. Needs focus
10. Needs communications infrastructure to allow for distributed / parallel problem solving
11. Group vs. matrix
12. Criteria for selection of team members
13. Mechanism for avoiding overly bureaucratic approach
14. Team structure - e.g. hierarchical
15. Team member strengths and capabilities

Structure/Organization: Creative Solutions

1. Tiger teams, focus groups
2. Workshops to define common goals
3. Align R&D's organization with clients
4. Regular exchange of personnel R&D with client as well as international exchanges

5. Exchange of personnel with industry
6. Critical mass available for areas of high interest
7. Familiarity of researchers with the clients' working environment
8. Focus of C2IS research within CRAD in one area of endeavour
9. Decisive and flexible allocation of funding across CCs for C2IS research
10. Assemble a team for the duration of the project
11. Out-of-the-box thinking
12. Field testing
13. Hiring new blood every 2 years
14. Closer links with university R&D in C2

Structure/Organization: Benefits

1. Quick turnaround
2. Decreased administration
3. Better communications flow
4. Happier user
5. Better work
6. Increased productivity
7. Cheaper
8. More efficient and streamlined process
9. Few people required
10. Clear direction for research
11. Less time spend in process
12. More stability, able to keep expertise
13. Better technology transfer process with industry
14. Focus of academic work (particularly theses at RMC)
15. Flexible and rapid resource re-allocation
16. Focus of R&D efforts in most appropriate area
17. Less interest in / work on 'pet' projects that don't relate due to better overall direction/control

Structure/Organization: Problems

1. Control structure may become too tight and inhibit creative process and development of new ideas
2. May waste time keeping everyone advised of all activities
3. Direction from above is seldom clear, normally because the funding is not known
4. Lack of control
5. Not enough experts; to get a centre of gravity
6. Most solutions are compromising (consensus vs. a hard decision)
7. As size of group increases, communication needs become excessive

8. Too many levels of approval required in a matrixed organization
9. Matrix management can lead to the goal of the organization being lost along with any accountability
10. With downsizing, matrix responsibilities will be ignored
11. Reduction in resources leads to inter-CC parochialism
12. No reward for advancing CF versus CC goals

Structure/Organization: Gut Feeling

1. Already in place
2. Will need to be rebuilt from scratch to ensure correct representation and to eliminate protectionism
3. People are people, doesn't matter how we stack 'em
4. Very important to get it right - streamline the process
5. Has to be simple and based on trust - not position of individuals
6. Mutual respect in team important
7. Must avoid too many layers of management which slows down all processes
8. Government and industry labs must be better integrated

CONCEPT B: CO-ORDINATION AND COMMUNICATIONS

Idea Base:

2. Military presence in labs.
3. Common team model.
4. Assesses areas of most impact (including industry).
5. Fast turnover.
6. Small co-ordinating committee.
7. Bottom-up process (define requirements).
8. Modular architecture (allies), COTS.
9. Better integration with industry.
10. Joint/team workshops.
11. Real-time communication between team members.
13. Top-down direction.
14. Focus/ niche specialization.
16. Formalization of activities and responsibilities.
18. Increase military awareness on the part of scientists.
19. Focus on joint/combined ops.
20. Flexible reallocation of resources.
25. Commitment to actually procure once R&D is done.
26. Military input in prioritization of R&D.
29. Base product must be clearly defined.

32. Maintain international contacts.
35. Adequate resources up front.
37. Time and money commitment up front.
38. Opportunities for players to see what ultimate participation opportunities may be.
39. Promote dialogue for honest communication of information.
42. Constant interchange between team members.
43. Mechanism for co-ordination.
44. Discussion and consensus building.
45. Informal contact within formal structures.

Co-ordination & Communications: Information Requirements

1. Communication networks (cheap)
2. Identify players
3. Identify appropriate methods for co-ordinating and for communications
4. Plans of other team members, especially, long term, including resources
5.. Participation of labs in 'trials/exercises'
6. External IM architectures/policies/doctrine (OGD and Allies)
7. Monitoring of current state of IM development
8. Agreements/lines of communication with allies, industry, academia, for rapid exchange of information
9. One small overall body in charge made up of one member from each of the major players
10. Requirement of information to track progress/non-progress of R&D

Co-ordination & Communications: Creative Solutions

1. Drugs and rock and roll
2. Standard protocols
3. Paperless bureaucracy
4. Computer tracking of entire process
5. Lateral empowerment
6. Centrally located teams
7. Single location for team
8. Sufficient travel funds for bi-weekly team meetings
9. Desktop to desktop video conferencing, white-boarding
10. Scientists on clients' procurement teams, military people in labs
11. Electronic communications (e-mail, video-conference)
12. Distributed access to various testbeds to evaluate products and test for interoperability
13. DND/CF-wide strategic direction

14. Overseeing body acts mainly as a chair/facilitator. Everyone knows what is happening
15. Information is freely exchanged with no concern for who developed a particular idea or solution

Co-ordination & Communications: Benefits

1. Everyone has access to all information, therefore no duplication effort
2. Instantaneous communications leads to quick decisions which minimises time spent waiting
3. Less wasted resources, therefore cheaper
4. Fewer people required
5. Better tracking of R&D projects, i.e., money/people/time
6. Better end product, i.e., Interoperable, etc.
7. It is clearer what requirement is
8. Can change direction quickly as requirement changes
9. Allows us the benefit of the whole team's expertise and knowledge
10. Co-ordination with allies more efficient system
11. Better focus and accountability of IM R&D
12. Precise definition of requirement
13. Flexibility, able to be 'opportunistic'

Co-ordination & Communications: Problems

1. Parochialism will torpedo progress and introduce 'stalemate'
2. Protection of 'pet' projects
3. Decentralized funding will make personnel able to float central standards/direction
4. Project is so large that co-ordination will not be possible
5. Volume of communications may overwhelm capacity of people to stay current
6. Requirement to keep people informed may cause less actual work to be done
7. Reporting of data to track R&D process might be a time-consuming event
8. Missed information
9. Information overload
10. How much co-ordination is really necessary for small effort
11. Cost of communications (IT systems, and travel)
12. At critical mass in some areas, not enough resources to do proper job of co-ordinating
13. If control is spread too thin accountability is lost

Co-ordination & Communications: Gut Feeling

1. R&D effort has to be co-ordinated with the client / the product must fill a need
2. Good communications between clients and scientists is essential to deliver the appropriate product
3. Critical for good R&D
4. Without effective co-ordination and communications, project will get bogged down, mistakes will be made and resources wasted; communication co-ordination is essential
5. A must but we have to learn from our own mistakes; they get posted
6. Critical
7. Need to make it an essential part of our training process in R&D Branch - takes work to do it right
8. Absolutely essential for effectiveness

CONCEPT C: MECHANISMS FOR EXPERIMENTATION, FIELDING, TRAINING, TESTING AND EVALUATION

Idea Base:

4. Assesses areas of most impact (including industry).
5. Fast turnover.
17. Link test and evaluation to R&D.
24. Staged fielding.
25. Commitment to actually procure once R&D is done.
26. Military input in prioritization of R&D.
28. Feedback mechanism to show progress and effectiveness (or lack thereof).
33. Availability of experimental test facilities with humans in the loop.
34. Evolutionary development.
36. Scientific adoption of common core of services.
40. Battle lab testing.

Mechanisms for Experimentation...: Information Requirements

1. Battle labs
2. Fiscal requirements
3. Beginning states - end states
4. LIVEX (?)
5. Resource (manpower) requirements
6. Training requirements
7. Infrastructure requirements
8. Appropriate measures of performance

9. Availability of subjects for testing
10. What level of fidelity is required of simulation drivers for testing
11. Involvement in test and evaluation process by labs to gain background in field environment
12. Distributed interactive simulation
13. Existing architecture for DND/CF
14. Interoperability needs (both internal and external DND)
15. Composition of common user core (IM resources upon which the applications are built)
16. Test and evaluation at all levels (in lab, development models, pre-release, post-release)
17. Testing to be done by users with assistance from developers
18. Both structured and non-structured testing

Mechanisms for Experimentation...: Creative solutions

1. Have realistic simulation in place for testing
2. Connect test lab in parallel with an operational system during actual operations and compare results
3. Deploy development models for testing in the field
4. Rapid prototype tools
5. Use of single tiger team from start to finish
6. Dedicated test beds
7. Data collection in fielded systems during training
8. Use evaluation results to redirect resources
9. Share common testbeds with allies
10. Availability of large scale testbeds
11. Provide feedback to clients
12. Electronically co-located family of testbeds addressing CC concerns in the context of an overall interoperable environment
13. Staggered implementation using V1 (fielded), V2 (battle lab), and V3 (R&D)

Mechanisms for Experimentation...: Benefits

1. Faster delivery of capability to users
2. Less waste of R&D resources with increased focus
3. Less bureaucracy
4. More usable IM resources
5. More user input in final product - better first solution
6. Bugs and defects get found and fixed quickly
7. Users are trained before receiving the product
8. Risk reduction

9. Training improves operator competency
10. Should allow focusing of effort where it is needed
11. Can assess if the new technology helps or hinders
12. Provides vehicle for drawing together all aspects of the problem to get a much better solution
13. Aids in the evolutionary development of systems
14 Better understanding of user requirements and environment
15. Allowing different aspects to be tested at same time

Mechanisms for Experimentation...: Problems

1. Dilution of manpower resources - T&E could take over a large percentage of resources
2. If carried out ineffectively could lead to inefficient use of resources
3. Testbeds will not be able to field due to DPMS
4. If research is overly emphasized, then fielding hindered
5. Requirement to 'publish or perish' will cripple fielding
6. Use of test facilities may be impeded by security concerns
7. R&D may be forced to hit a moving target because operators will never be satisfied or will never agree
8. Test beds require operating resources, i.e., Ships, planes, that are over-tasked already - hard to do
9. Risk acceptance is hard to achieve and costly
10. Test bed version could become fielded version even though it is not complete - operators will want it right away

Mechanisms for Experimentation...: Gut feeling

1. This is absolutely essential to have superior systems
2. An efficient method for permitting teamwork, co-ordination and benefits
3. Testing is essential to ensure the end-product performs the functions it is designed for
4. (Operational) testing shows the weakness in the system and the operator and leads to a better understanding of the requirement for new and improved systems
5. Crucial if C2IS R&D is to continue
6. If final product is to be worthwhile, testing by the user at all levels of development is required
7. Got to be done right or the whole thing falls apart

CONCEPT D: TEAM CULTURE

Idea Base:

1. Large enough Centres of Excellence for critical mass.
2. Military presence in labs.
5. Fast turnover.
6. Small co-ordinating committee.
7. Bottom-up process (define requirements).
10. Joint/team workshops.
11. Real-time communication between team members.
13. Top-down direction.
18. Increase military awareness on the part of scientists.
20. Flexible reallocation of resources.
22. Flat command structure.
25. Commitment to actually procure once R&D is done.
26. Military input in prioritization of R&D.
27. No padding of team just to have a group represented.
30. Long-term commitment of/by personnel.
37. Time and money commitment up front.
39. Promote dialogue for honest communication of information.
41. Get rid of rank consciousness.
44. Discussion and consensus building.
45. Informal contact within formal structures.

Team Culture: Information Requirements

1. What do we do that impedes the R&D effort and what do we need to change
2. Development process often seems unfocused
3. Rapid turnover of personnel leads to lost productivity
4. Need a goal, a vision to give direction to the process
5. Better understanding of team members' perspectives, constraints, priorities
6. Mechanism for achieving shared vision
7. Empowerment (flattening of rank structure)
8. Government researchers working within industry
9. Best member for job, regardless of rank and/or position and/or branch of service (personnel information)
10. Have 'human resources' regarded as most important

Team Culture: Creative Solutions

1. Human resource selection from entire spectrum of DND/CF across environmental/branch and rank boundaries
2. Empowerment function of position rather than rank
3. Better/more mix of scientists/engineers and users
4. Have users work with engineers in lab to validate proposals
5. Assign personnel to the project for 6-10 years (to avoid requirements for retraining)
6. Leave decisions in the hands of the operators
7. Lock scientists in closet until they come up with the solution
8. Risk acceptance
9. Error development
10. Exchange scientists and operators; scientists on operational missions
11. Pay scientists better (motivation)
12. Get scientists into the field occasionally (reality test)

Team Culture: Benefits

1. Scientists better attuned to the client
2. Flattening of 'rank structure' will result in better use of resources
3. Less tendency to fight the last war 'well', fresh ideas and fewer pre-conceived notions
4. Lower rank may decrease experience but increase currency
5. Less rubber stamping of correspondence = time savings
6. Less official correspondence to people who don't need to know means more time to do actual work
7. Faster turn-around of staffing
8. Clearer knowledge of roles within the organization
9. Decreased road blocks
10. Client can get better understanding of R&D benefits, limitations, time cycles

Team Culture: Problems

1. Hard to change the culture; it is well engrained
2. Need to protect the Minister means lots of checks in process
3. Hard to discover hidden agendas
4. Lack of resources to support exchanges
5. Chaos - there has to be someone in charge
6. Control of the R&D process by the 'client' may lead to a large development effort with little or no long term research
7. Military will say 'culture change' and not mean it

8. Civilians will use 'scientific curiosity' or 'academic freedom' excuses to carry on marginal or irrelevant research/development
9. If culture changes too much it may result in confusion
10. 'System' may rebel and block project because it wasn't done 'by-the-book'
11. Getting rid of rank structure in NDHQ is smoking-dope thinking - it will not happen
12. No rewards to advance DND/CF cause, only rewards for advancing environmental needs

Team Culture: Gut Feeling

1. Change of culture may be essential to speed process but will be resisted
2. Take two generations to come about
3. Very dangerous - if it gets out to the field bad news - there can be only one commander at the sharp end
4. Will take a long term concentrated approach to change it
5. A fundamental issue
6. Take a long time to change the culture within large organizations such as DND
7. There has to be better communication/empowerment within the establishment

CONCEPT E: EXTERNAL INFLUENCES (EXTERNAL TO R&D)

Idea Base:

4. Assesses areas of most impact (including industry).
5. Fast turnover.
8. Modular architecture (allies), COTS.
9. Better integration with industry.
12. Permits R&D to be integrated into the final system without re-doing it.
14. Focus/ niche specialization.
20. Flexible reallocation of resources.
22. Flat command structure.
24. Staged fielding.
25. Commitment to actually procure once R&D is done.
31. Streamlined acquisition.
32. Maintain international contacts.
34. Evolutionary development.
35. Adequate resources up front.
36. Scientific adoption of common core of services.

37. Time and money commitment up front.
38. Opportunities for players to see what ultimate participation opportunities may be.

External Influences: Information Requirements

1. Architecture, vision
2. Long term plans
3. Funding availability
4. Personnel availability
5. Status of industrial achievement
6. Existing organizations industry/academia
7. Co-ordination with Allies
8. Interservice co-operation (or lack thereof)
9. Public perception of requirement
10. Capability and limitations of external influences
11. Global situation, assessment
12. Roles of CF / missions
13. Commitment to R&D
14. Stability of resources
15. Mechanism for showing benefit of long-term perspective
16. Acquisition process
17. Political considerations

External Influences: Creative Solutions

1. Block funding to research organization with an X-year plan (set minimums for funding and personnel)
2. Multi-inter-service collaboration
3. International C2IS standards to include: Architecture, data/information/knowledge models, standards
4. Government of Canada-wide C2 based on DND/CF
5. Allied co-operation on developing architectural modules
6. Develop world-wide database structure
7. Take politicians out of decision matrix
8. Suffer from green hat envy
9. Move R&D Branch out of ADM(Mat) so they respond to operators and not supply system
10. Create stability in resource levels
11. Move resources from re-engineering back to R&D
12. Allow rejuvenation

External Influences: Benefits

1. Block funding would create stable climate, and allow us to attract bright young scientists with current knowledge again
2. Could share costs with allies
3. Lay framework for interoperability for coalition operations in all intensities of conflict
4. Survivability in high intensity conflict
5. Design for interoperability will lead to one single solution
6. External influences are aware of project and might volunteer information
7. Common (US) core in C2 R&D will be cheaper, more efficient and help focus effort where Canada can find niche

External Influences: Problems

1. NATO syndrome (protracted approval)
2. Money is very scarce, have to program for long term funding
3. Paying for something we don't need (if we go US based common core)
4. Reliance on other nations
5. Hard to co-ordinate with allies, they have different objectives, be in different part of process
6. Releasibility of information issues
7. Protection of intellectual property
8. Have to do enough in-house to be a credible trading partner with allies
9. Could hurt domestic industry if foreign systems are constantly acquired (also kills local research)
10. Tied into foreign procurement process (i.e. Foreign military sales)
11. No say in configuration for government off-the-shelf
12. Larger nations have larger budgets and drop entire projects overnight
13. May lose some of our own capabilities in areas that we are getting stuff from other sources

External Influences: Gut Feeling

1. Don't know what this one means
2. It'll never happen
3. Important to include outside agencies in the process
4. This will be very hard to tackle. But it is one of our biggest problems
5. Hard to change?
6. Important but hard to realize...
7. Fundamental to the survival of R&D; the idea of marketing defence R&D is critical to industry participation

8. Very important as these influences (industry, OGD, allies) define the bounds of C2IS research

PRIORITIZATION

VOTING SUMMARY[1]

	P1	P2	P3	P4	P5	P6
A. Structure/Organization	5	4	1	4	1	3
B. Co-ordination/Communications	2	3	2	1	2	2
C. Mechanisms for Experimentation	1	2	3	3	4	1
D. Team Culture	3	1	5	5	5	4
E. External Influences	4	4	4	2	3	5

AVERAGE RANK

	Average Rank
A. Structure/Organization	3
B. Co-ordination/Communications	2
C. Mechanisms for Experimentation	2.3
D. Team Culture	3.8
E. External Influences	3.7

[1] Table format: columns show prioritized concepts (1..5) from each layer (P1..P6); rows show votes for each concept (A..E)

ANNEX B
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SYNDICATE 2B: PROCESSES AND STRUCTURES

INTRODUCTION

B-1. Session 2 consisted of all six syndicate groups examining the same question:

"What structures and processes should be put in place to establish a team approach to C2 R&D in the department that will meet the current and future needs of the CF?"

Syndicate 2B developed 28 ideas which were grouped into the following 6 concepts:

a. Accountability;

b. Strategic R&D direction;

c. Effectiveness;

d. Efficiency;

e. Stability (in terms of personnel); and

f. R&D process integration.

B-2. The following format is used in documentation. For each concept:

a. Idea base for each concept (generated via the Nominal Group Technique);

b. Idea development for each concept (generated via Ideawriting and the Six Thinking Hats):

(1) Information needs;

(2) Creative solutions;

(3) Benefits;

(4) Problems; and

(5) Gut feelings;

c. Prioritization (syndicate member votes):

(1) Voting summary (anonymous vote matrix); and

(2) Consensus Decision Support Program (CDSP) computer program analysis.

B-3. Voting results were tabulated. Scores and average ranks appear at the end of this annex. This syndicate assessed concepts in the following order of priority:

a. Effectiveness (Concept C);

b. R&D process integration (Concept F);

c. Strategic R&D direction (Concept B);

d. Efficiency (Concept D);

e. Accountability (Concept A); and

f. Stability (Concept E).

IDEA INVENTORY

1. Allocation of R&D funding through the business plan of the capability service in question, rather than an R&D business plan.
2. Long term (5 yr.) R&D baseline for Techbase research.
3. Commitment of operators in each R&D project.
4. Closer ties between user community (including EPMs) and R&D and industry.
5. Include other departments in government (process in place).
6. Form more stable and cohesive structure for project offices (matrix team members).
7. Thrusts funded/sponsored by a capability components; specific requirements sponsored by projects.
8. Co-locate wherever possible R&D staff and the information service delivery staff.
9. International participation.
10. Improve mutual understanding and experiences.
11. Development of a clear pipeline to get research -> development -> tech exploitation in 5 years.
12. Maintain core basic scientific capabilities.
13. Maintain defence scientific community as a way to focus new technologies to defence applications.
14. Rapidly prototype with a team.
15. Empower the info service manager to be accountable for the R&D needed to enhance or develop particular capability.
16. Relationship of scientists within CRAD and relationship amongst R&D establishment.
17. Encourage supervisorship/sponsorship of postgraduate students in R&D.
18. Maintain the R&D worth for next generation product (evolutionary process).
19. Have minimum process and minimum manning.
20. Change the whole procurement process.
21. Manage R&D projects as a risk portfolio.
22. Interoperability Army/ Joint/ Combined/ International.
23. Contracting processes.
24. Link to OR process.
25. CRAD should make decision about reducing scope of R&D.
26. Implement automation to support departmental wide processes.
27. Timeliness of R&D.
28. Mission oriented.

CONCEPT A: ACCOUNTABILITY

Idea Base:

1. Allocation of R&D funding through the business plan of the capability service in question, rather than an R&D business plan.
7. Thrusts funded/sponsored by a capability components; specific requirements sponsored by projects.
8. Co-locate wherever possible R&D staff and the information service delivery staff.
14. Rapidly prototype with a team.
15. Empower the info service manager to be accountable for the R&D needed to enhance or develop particular capability.
20. Change the whole procurement process.
21. Manage R&D projects as a risk portfolio.
23. Contracting processes.
26. Implement automation to support departmental wide processes.

Accountability: Information Needs

1. Output requirements
2. Time requirements
3. Maximum use of R&D for various requirements
4. Process not unilateral - higher approval required
5. Needs close relationship and openness between PMO and scientist
6. Clear connectivity between client needs, funding and results (historical, perspective) through date basis
7. Integrate R&D with the BP process of the associated CCs who are accountable for the co[illegible] and performance of the capabilities under their purview

Accountability: Creative Solutions

1. Bring in Auditor General
2. Make scientific advisors (SAs) responsible for program formulation and delivery for their CC - down rank DG of labs to be subordinate to SA
3. Accountability towards the users, not necessarily towards superior/higher management
4. Empower management to commit resources
5. Modify DPMS, bring approval to Minister
6. MOE/MOP methodology development
7. Make short term, capability-specific R&D just another function associated with service management

8. Business planning process
9. Make PM defence off-the-shelf purchase when R&D-based technology is available
10. Functionality not good enough! Contractor always delivers less - demand 100% of FRS (SOR)
11. Keep entire PMO for Capital Project together (no posting) from definition Of SOR to final delivery of system to field

Accountability: Benefits

1. Ensuring users will get what is needed by them to do the job
2. Funds and resources better focused on needs
3. Defensible in a declining funding envelope
4. Fits into D2000 framework
5. Increased stakeholders' confidence in defence R&D
6. Less waste
7. Force better interoperability
8. Efficiency improved
9. Better chance of fielding systems that work!
10. Reduces time spent training PMs and establishing relationship between PM/LLCM and labs.
11. Better working relationship

Accountability: Problems

1. Concept not will liked by officers, impacts careers
2. Hard to establish and enforce
3. Will require longer postings, limits career growth
4. How do you assign accountability to scientists
5. Senior leaders change too rapidly
6. Who has been held accountable?
7. R&D is generally too long term for real start-to-finish accountability
8. Always look for scapegoats
9. Nobody will allow for the same person to be both responsible and accountable for R&D projects!
10. Risk to compromise requirements
11. Too loose long-term focus

Accountability: Gut Feelings

1. Very important in reducing money envelope
2. Helps keeping focus
3. Counter-culture

4. Powers that be will not make the changes needed to assign real accountability to the levels required to improve procurement process
5. Difficult to match authority with long term responsibility when officers are posted frequently
6. More effective for short to mid term research, not possible for long terms greater than 5 years
7. Difficult, but important
8. The most effective way of focusing R&D effort on what is important

CONCEPT B: STRATEGIC R&D DIRECTION

Idea Base:

2. Long term (5 yr.) R&D baseline for Techbase research.
18. Maintain the R&D worth for next generation product (evolutionary process).
21. Manage R&D projects as a risk portfolio.
25. CRAD should make decision about reducing scope of R&D.
26. Implement automation to support departmental wide processes.

Strategic R&D Direction: Information Needs

1. Government R&D Policy
2. Long/mid/short term R&D emphasis
3. Impact on DND R&D emphasis/budget
4. Good knowledge of requirements
5. Implication of CRAD in requirements capture
6. Long term operational plans
7. Direction now and in the future
8. CRAD/DS involvement in definition and maintenance of requirements document
9. Need closer ties between R&D teams and PM/
10. LLCM
11. Maintain current knowledge of technology
12. Integrate with long term business plans
13. Align R&D strategic direction with DND/CF strategic direction which in turn provides guidance for the Force Generation and Force Employment process

Strategic R&D Direction: Creative Solutions

1. CRAD HQ responsive to government DND R&D policy and needs
2. R&D staff involvement in academic circles
3. R&D government effort/structure (with other government departments (OGD) mixed)

4. Align R&D with the strategic direction that is issued to guide the development of each CCs capability
5. Must also keep CRAD as independent honest broker for strategic direction, not force to follow the thinking mode of the day
6. Use business plan (5+ years) to dictate thrusts
7. Use R&D to reduce long term risks
8. Have operators document their long term vision for their forces as a guide for R&D (both doctrine, and roles and priorities)
9. Complement R&D activities with allied activities
10. Let individual scientists make own long term R&D plan, in co-operation with specific military user

Strategic R&D Direction: Benefits

1. Clear vision
2. Direction fits CF needs
3. Good knowledge of R&D direction by CF
4. Blessing by higher management to pursue R&D activities in certain areas
5. Would create more stable process
6. More easily defensible
7. Better direction to industry for R&D priority
8. More efficient
9. Ensures all effort is directed to achieving the vision and mission of the DND/CF
10. Scientists can focus their efforts to be consistent with strategy
11. Make users part of development process

Strategic R&D Direction: Problems

1. Danger to get funnelled into investigating wrong or not important technologies
2. Hard to keep stable
3. Tough decisions are rarely made
4. Too much emphasis on strategic direction can result in major waste of effort if there is a major shift in that direction (change in world situation/government)
5. Conflict with allied R&D direction
6. Harder to keep focus - waste resources
7. Not as responsive to user requirements
8. Strategic direction, if not properly focused can be interpreted (read 'distorted') any way that is desired by people who are primarily interested in maintaining their functions
9. No one wants to cut projects
10. Who decides what is going to be important 10 years from now?

11. Never will get the proper funding committed on time to exploit new technologies

Strategic R&D Direction: Gut Feelings

1. Important but must remain a high level direction from higher management - must avoid 'micro-management'
2. Relationships between labs, PMO, LLCM, and industry will be hard to maintain
3. Requirements are always changing, strategic direction will also
4. A necessary starting point
5. Second priority (after accountability)
6. Very important but must not use/drive all resources - R&D must remain focused to requirements
7. Real impact on R&D is likely minimal, a lower priority

CONCEPT C: EFFECTIVENESS

Idea Base:

3. Commitment of operators in each R&D project.
4. Closer ties between user community (including EPMs) and R&D and industry.
8. Co-locate wherever possible R&D staff and the information service delivery staff.
14. Rapidly prototype with a team.
24. Link to OR process.
26. Implement automation to support departmental wide processes.
27. Timeliness of R&D.
28. Mission oriented.

Effectiveness: Information Needs

1. Availability to move
2. Determine value added of structures or processes
3. Learn the operators' and engineers' perspective (client focus)
4. MOE, MOP
5. Integrated part of service delivery team
6. Need performance indicators for actual performance and benchmarks for comparison - the shortfalls should drive specific R&D efforts
7. Team up with OGD for long-term R&D
8. How to train scientists in military operations and how to train military personnel in R&D matters/process
9. Means of measuring effectiveness - can the troop do the job?

10. Ability to react quickly to immediate operational requirements
11. New organization structure to support above

Effectiveness: Creative Solutions

1. Teach scientists the military position/job
2. Have end user critique system/R&D
3. Put PM/LLCM in CRAD labs
4. Dedicate part of lab to support single PM/LLCM shop (combat function)
5. Post officers to labs for 1-2 years
6. Co-operate with industry
7. Locate labs with users
8. Integrate MOE/MOP into systems
9. Longer military postings in R&D positions
10. Interoperability
11. International co-operation
12. Put scientists in operational environment
13. Streamline structures and processes to reduce overhead
14. Reduce number of labs
15. Ensure 'new blood' trickles through scientific community in DND
16. To focus on acceptable solutions vs. Perfect solutions
17. Co-locate R&D staff and facilities with in-service management staff

Effectiveness: Benefits

1. More direct application of R&D effort with actual requirement
2. More responsive/less waste
3. Effective empowerment of people who are actually accountable for cost and performance
4. Higher client confidence in defence R&D
5. Products which are delivered on time and meet the users' needs
6. Better synergy between labs - less duplication
7. Battle Lab provides enabler for all of the above points
8. Faster delivery of good technology to the field
9. Interoperability
10. Better responsiveness to requirement
11. Will encourage more use of R&D
12. Leverage small R&D community

Effectiveness: Problems

1. Cost related to posting in labs
2. Loss of operational resources used for R&D

3. Responsiveness
4. Timeliness
5. How do you measure this?
6. Too tied to current process
7. Requirements not defined by the right people so the end result is not what the user community wants

Effectiveness: Gut Feelings

1. In today's climate, we cannot afford not to be doing anything that is not effective
2. A must have. Definitely do-able
3. First priority
4. Very important, but R&D priority must be clear and consistent in lower $ envelope
5. Essential - first priority - a method to measure must be determined
6. Co-location: danger to get R&D dragged into solving mundane day-to-day problems and forgetting the larger aspect of it (co-location with the user community)
7. A team approach to R&D (labs, users, projects, industry) is best to be effective

CONCEPT D: EFFICIENCY

Idea Base:

5. Include other departments in government (process in place).
9. International participation.
11. Development of a clear pipeline to get research -> development -> tech exploitation in 5 years.
14. Rapidly prototype with a team.
17. Encourage supervisorship/sponsorship of postgraduate students in R&D.
19. Have minimum process and minimum manning.
27. Timeliness of R&D.
28. Mission oriented.

Efficiency: Information Needs

1. Define which branch/service/project would need streamlined acquisition process
2. Determine total cost of current capability
3. Establish matrices for MOE/MOP
4. Establish target goals and milestones aggressively
5. Establish direct relationships between scientists and end-users

6. Determine which technologies to focus on for long term R&D
7. Reduce time from lab to field
8. Evolutionary development
9. Link to other BP activities
10. Build military expertise in labs
11. How are other countries/departments doing this efficiently

Efficiency: Creative Solutions

1. Integrate with requisitioners/SWE delivery
2. Leverage STC/allied work
3. Use gatekeepers on technology
4. Co-opt personnel into industry
5. Streamline the R&D process by eliminating 'hand-offs' and need to specify 'requirements' to external organization
6. Briefing on future capabilities and limitations of the technology
7. Use military personnel as part of R&D team
8. Streamline contracting process
9. Make statement of requirements (SOR) a living document
10. Continually (1-2 years) upgrade fielded systems using R&D
11. Streamline the pipeline to get R&D solutions integrated into acquisition process, even by letting the labs manage the development of systems with PMOs
12. Reduce overhead - less labs, less process, fewer managerial levels

Efficiency: Benefits

1. PY savings
2. More responsive
3. Better fulfil the requirement
4. Better direction on requirement to R&D staff
5. Cost effectiveness movement
6. Could contract to industry if proven affordable
7. Fits within re-engineering department
8. Reduce wasted effort on R&D that project will not use or benefit from
9. Focuses efforts to support end user
10. Helps with overall downsizing effort (hopefully)
11. Dual use of military technology - commercialization
12. Cost sharing with OGD
13. More synergy due to less overhead interfering with scientific effort
14. Leverage off industry and other departments and government allows concentration on more difficult problems

Efficiency: Problems

1. Overdoing efficiency to the point where product suffers, i.e., Must maintain minimum capability in some areas and redundancy in case of death, etc.
2. Concentration of all effort on development vice research because of more focused nature of development. More efficient in short term but not long term
3. Bureaucracy will clog the path on contracting out R&D
4. Empires hard to 'move'
5. Less responsiveness to requirements
6. Our track record in prioritizing work has not been impressive (we keep trying to do everything)
7. Few incentives to become more efficient
8. Efficiency of long term research activities

Efficiency: Gut Feelings

1. Second priority
2. Hard but necessary
3. Difficulty in measuring to determine efficiency makes this hard to achieve
4. Must get biggest bang for the buck
5. Important but must not compromise requirement (50% solution)
6. It is possible to get better and cheaper if one capitalizes on R&D solutions provided and includes them into procurement process
7. Co-operation between lab and projects only way to be more efficient in using R&D

CONCEPT E: STABILITY

Idea Base:

1. Allocation of R&D funding through the business plan of the capability service in question, rather than an R&D business plan.
2. Long term (5 yr.) R&D baseline for Techbase research.
4. Closer ties between user community (including EPMs) and R&D and industry.
6. Form more stable and cohesive structure for project offices (matrix team members).
9. International participation.
12. Maintain core basic scientific capabilities.
13. Maintain defence scientific community as a way to focus new technologies to defence applications.

Stability: Information Needs

1. What positions require stability?
2. When does stability become staleness?
3. Are stability requirements same for all positions?
4. How can long term defence scientist be maintained
5. Where do new scientists come from
6. Where do new PM/LLCM get technical training in C2IS?
7. How can officers be rewarded for long postings
8. How can troops be posted longer
9. Stability with industry?
10. Stability with other departments
11. Establish mix civilian/military with longer legs
12. How can we put in place longer posting for CF members working on R&D projects (accountability)
13. Rejuvenation program to allow new DS - new technologies - new ideas

Stability: Creative Solutions

1. Pair up military personnel from requirements/project offices with defence scientist from CRAD for longer period
2. Longer postings
3. Mix civilian/military
4. Technical stream for military personnel
5. Use IT to reduce ramp up time and suggest new participants
6. Provide training
7. Document how present situation reached with rationale so new personnel can get up to speed quickly
8. Make all PMs do posting in lab
9. Have more civilian personnel in labs, more DS, CS, Eng and less contractors
10. More liberal links to industry (if justified)
11. Incorporate R&D planning and R&D activity into business planning and with the other functions for capabilities in question
12. Encourage the creation of 'centres of excellence' within labs in partnership with industry

Stability: Benefits

1. Would promote longer term relationships between R&D and users/PMOs
2. Would reduce uncertainty about funding
3. Would enhance industrial and defence teaming
4. Would provide consistency of direction/advice from client
5. More efficient - less time spent 'getting up to speed'

6. Less waste
7. Greater personal commitment on the part of R&D staff to finding innovative solutions to meet operational requirements
8. More effective
9. Less changes in direction/priorities of R&D
10. Better 'team' integration
11. Will allow Canada to share/export technologies development from R&D
12. Will allow CF to benefit from work done in OGDs offshore
13. Will make project more accessible and more effective
14. Will better support the troops!
15. Preservation of 'defence science', corporate memory, and know-how acquired

Stability: Problems

1. Building up of little empires
2. Hermetic control over information flow
3. Less timeliness
4. Less receptive to innovation (not made here syndrome)
5. Sick of 'patronage' with industry
6. Risk of losing 'pure R&D' capability
7. How do you get out of a bad relationship with PMO or industry?
8. Scientists get stale, no new ideas
9. How can you support rapid development and long term research
10. Too much is changing around us
11. Inefficient

Stability: Gut Feelings

1. Could be useful but must avoid stagnation
2. Must be controlled
3. Not a serious issue
4. A 'no brainer'
5. Lowest priority, but still important
6. We have to learn how to manage the change
7. Will not be able to achieve stability with downsizing
8. Extending posting cycle will not be popular
9. Long term commitment to R&D is weak
10. Important in order to deliver the right product to users in time and to spend lead time educating new players

CONCEPT F: R&D PROCESS INTEGRATION

Idea Base:

1. Allocation of R&D funding through the business plan of the capability service in question, rather than an R&D business plan.
3. Commitment of operators in each R&D project.
4. Closer ties between user community (including EPMs) and R&D and industry.
5. Include other departments in government (process in place).
7. Thrusts funded/sponsored by a capability components; specific requirements sponsored by projects.
10. Improve mutual understanding and experiences.
20. Change the whole procurement process.
22. Interoperability Army/ Joint/ Combined/ International.
23. Contracting processes.
24. Link to OR process.

R&D Process Integration: Information Needs

1. Sharing requirements among lab, PM, LLCM
2. Agreement of /definition of roles
3. Co-location of scientists/sponsors
4. Integrated team delivery
5. Continuum of processes to meet requirements R - OR - development - def - implementation
6. International co-operation
7. Responsiveness to user requirements
8. Have CC sponsors plan for associated R&D in their business plans (vice CRAD BP)
9. Identify what information must be shared and by whom
10. How to get faster support from higher levels of management (improving faster turn-over on projects)

R&D Process Integration: Creative Solutions

1. Run development project from labs
2. Run research projects from PM/LLCM
3. Contract out scientists to industry developing systems
4. Allow total freedom in contracting
5. Integrate R&D 'success with CC business planning process
6. Co-locate labs with users
7. Involve R&D from requirement definition
8. Integrate with SWE delivery team

9. Appoint personnel from both ends of the R&D process (military and defence scientist) to work either in the labs or in location with users where it is more appropriate
10. International focus/involvement
11. Battle labs as focus for process integration

R&D Process Integration: Benefits

1. More streamlined fielding
2. More responsive to user managers
3. Enhanced visibility of R&D within business plan
4. Better inter-operability
5. Cleaner focus
6. Less duplication/gaps in R&D efforts
7. Greater accountability
8. Better visibility of total cost of particular capabilities
9. Enhanced communication between all stakeholders, therefore better understanding
10. Greater efficiency and effectiveness
11. Easier corporate memory preservation for CRAD
12. Improved technology transfer between CRAD and industry
13. Reduce wasted effort
14. Put new technologies into the field faster

R&D Process Integration: Problems

1. 'Cultural' problems
2. Turf/rice bowl problems
3. Fear that 'other' side of the integrated process will be short-changed
4. No current process defined
5. Cost of change
6. How can change be measured
7. Danger to fall into too rigid a structure not allowing for fast change
8. Change due to new requirements
9. Close ties between R&D and projects can hurt long-term R&D by putting on blinders
10. Danger of linking R&D programs to capital projects as capital projects 'slide to the right' and have unstable funding
11. Cost
12. May be hard to implement

R&D Process Integration: Gut Feelings

1. A must do
2. A key to effectiveness and efficiency
3. Necessary to work together
4. Yes - tied to accountability if one person is responsible for whole/integrated process
5. Essential to improve the process
6. Important to better serve the client/users

PRIORITIZATION

VOTING SUMMARY

	P1	P2	P3	P4	P5	P6	P7
A. Accountability	5	5	6	4	1	3	5
B. Strategic R&D direction	6	3	2	5	3	4	4
C. Effectiveness	1	2	3	1	4	1	1
D. Efficiency	4	6	4	2	5	5	2
E. Stability	2	4	5	6	6	6	6
F. R&D process integration	3	1	1	3	2	2	3

AVERAGE RANK

	Average Rank
A. Accountability	4.1
B. Strategic R&D direction	3.9
C. Effectiveness	1.9
D. Efficiency	4.0
E. Stability	5.0
F. R&D process integration	2.1

SYNDICATE 2C: PROCESSES AND STRUCTURES

INTRODUCTION

C-1. Session 2 consisted of all six syndicate groups examining the same question:

"What structures and processes should be put in place to establish a team approach to C2 R&D in the department that will meet the current and future needs of the CF?"

Syndicate 2C developed 39 ideas which were grouped into the following 5 concepts:

a. Organizational design;

b. C2 laboratory;

c. Management;

d. Strategic direction; and

e. Information dissemination.

C-2. The following format is used in documentation. For each concept:

a. Idea base for each concept (generated via the Nominal Group Technique);

b. Idea development for each concept (generated via Ideawriting and the Six Thinking Hats):

(1) Information needs;

(2) Creative solutions;

(3) Benefits;

(4) Problems; and

(5) Gut feelings;

c. Prioritization (syndicate member votes):

(1) Voting summary (anonymous vote matrix); and

(2) Consensus Decision Support Program (CDSP) computer program analysis.

C-3. Voting results were tabulated. Results and average ranks appear at the end of this annex. This syndicate assessed concepts in the following order of priority:

a. Strategic direction (Concept D);

b. Command and Control Laboratory (Concept B);

c. Information dissemination (Concept E);

d. Organizational Design (Concept A); and

e. Management (Concept C).

IDEA INVENTORY

1. Joint R&D teams.
2. Common R&D requirements.
3. Use training organizations for applied research.
4. Put in MOE (Measure of Effectiveness) hooks into operational systems.
5. Cost (overhead) of team formation.

6. Have R&D and engineering communities assist operational command in generating more complete requirements.
7. Should have more operational staff involvement in R&D.
8. Leveraging off international and industrial activities.
9. CRAD as contract manager for R&D.
10. Devolution of R&D funding away from CRAD to client.
11. CRAD HQ co-located with users.
12. Evolutionary development process with no throw-aways.
13. CRAD/CF periodical written by scientists for military.
14. Mentor/patronage system for dissemination of results.
15. How to balance need to maintain core competence vs. Maintaining flexibility to react to requirements.
16. Focus R&D efforts towards meeting inputs for engineering specs and end-users timeline.
17. New ways of managing R&D (new management structures).
18. Analyze and model command requirements and develop best ways to present it to the commander.
19. Re-allocation of DREs (Defence Research Establishments) or reduce the number of DREs.
20. Amalgamate all C2 research into one organization/ facility.
21. Establish a 'virtual' establishment with electronic linkages.
22. Greater interaction with allied/ international R&D to reduce potential for duplication of effort.
23. DREs do basic research, industry does applied research.
24. Education military community on need/ requirement for long-term research.
25. Create a separate organization to do basic research, and another to do development (government organizations).
26. Create experimental task force (Advanced Warfighter Experiments).
27. Revitalize CRAD by bringing in youngsters and renewing associations with universities.
28. Status quo.
29. Allow Defence Scientists to participate in field exercises.
30. Lessons learned from previous C2 systems.
31. Statement of Deficiencies should be held in repository.
32. Same for Concept of Operations.
33. Lab researchers work more closely with OR field stations.
34. Mutual education of team players (military education of scientists and vice versa).
35. Set up facilities joint with industry to do R&D and engineering testbeds, staffed by scientists, engineers, industry people to allow R&D to transition engineering prototypes with operator assessment.
36. Force development community to provide steerage of R&D efforts.
37. Commitment by users to research ideas.

38. This requires distribution of information.
39. Include engineering community into CRAD.

CONCEPT A: ORGANIZATIONAL DESIGN

Idea Base:

1. Joint R&D teams.
2. Common R&D requirements.
3. Use training organizations for applied research.
7. Should have more operational staff involvement in R&D.
9. CRAD as contract manager for R&D.
11. CRAD HQ co-located with users.
17. New ways of managing R&D (new management structures).
19. Re-allocation of DREs (Defence Research Establishments) or reduce the number of DREs.
20. Amalgamate all C2 research into one organization/ facility.
21. Establish a 'virtual' establishment with electronic linkages.
23. DREs do basic research, industry does applied research.
25. Create a separate organization to do basic research, and another to do development (government organizations).
28. Status quo.
33. Lab researchers work more closely with OR field stations.
35. Set up facilities joint with industry to do R&D and engineering testbeds, staffed by scientists, engineers, industry people to allow R&D to transition engineering prototypes with operator assessment.
39. Include engineering community into CRAD.

Organizational Design: Information needs

1. Direction in which organization is heading
2. Knowledge of level of R&D required
3. Number and type of personnel allocated to R&D
4. Political and regional realities (policies)
5. Interrelationship with operators
6. Resources
7. Constraints
8. Jointness
9. Reporting relationships
10. Responsible to who?
11. Goal
12. Interoperable with industry and countries
13. Priority of work

Organizational Design: Creative solutions

1. Align labs with CCs
2. One command and control lab
3. Combine R with EPMs
4. Combine D with EPMs
5. Separate R organizations
6. Separate D organizations
7. CRAD as a special operating agency
8. LOs
9. Co-location or virtual office
10. SME contributions
11. Tiger teams
12. Engineering contributions
13. Contract management of R&D
14. Combine all C2 R&D into one entity
15. Integration of operational staff in R&D community

Organizational Design: Benefits

1. More cost effective
2. More responsive to requirements
3. Better alignment with clients
4. Better solutions through synergy
5. Better leverage with industry and allies
6. Sharing risk with industry and allies
7. Better integration of R&D with operational requirements
8. Better product
9. Less redundancy/duplication
10. Reduced PYs
11. More efficient use of PYs
12. Greater organizational focus
13. Better communications
14. Better understanding
15. Reduced planning cycle
16. Risk reduction
17. Confidence

Organizational Design: Problems

1. Bureaucratic
2. Inflexible
3. Costly
4. Civilian/military differences
5. Hidden agendas
6. Job security
7. Power plays
8. Politics
9. Regional benefits
10. Working conditions
11. Empire building
12. Red tape bureaucracy
13. Possibly too many levels of authority (span of control problems)
14. Will reduce morale further
15. When we reorganize we do not do work
16. Efficiency/effectiveness low in transition periods
17. Best people tend to go during downsizing
18. Must rebuild expertise lost due to reorganization
19. Search for latest buzzword

Organizational Design: Gut feeling

1. Not necessary as R&D effort - can be left to senior direction to determine overall structure with respect to way-ahead
2. A design needed, but what type (not an R&D topic)
3. CRAD has been through several re-engineering processes (tiger-teams, strategic papers, downsizing, ...) In the past 5 to 6 years; this proposed organizational design better be the last one for a good period
4. Reorganizing is old hat (what colour is this) - unfortunately it is crucial because no process can function without a structure
5. Time to get on with doing the job instead of re-organizing once again
6. Time for the operators and DSS to get into bed with each other. Let's get rid of this 'we' and 'they'
7. Requires CRAD structural rework
8. Will probably result in some form of disorganization and may result in an organization that doesn't fit with the rest of the CF

CONCEPT B: COMMAND AND CONTROL LABORATORY

Idea Base:

1. Joint R&D teams.
2. Common R&D requirements.
4. Put in MOE (Measure of Effectiveness) hooks into operational systems.
12. Evolutionary development process with no throw-aways.
16. Focus R&D efforts towards meeting inputs for engineering specs and end-users timeline.
18. Analyze and model command requirements and develop best ways to present it to the commander.
20. Amalgamate all C2 research into one organization/ facility.
21. Establish a 'virtual' establishment with electronic linkages.
25. Create a separate organization to do basic research, and another to do development (government organizations).
26. Create experimental task force (Advanced Warfighter Experiments).
29. Allow Defence Scientists to participate in field exercises.

C2 Laboratory: Information requirements

1. Who controls it?
2. Who provides resources?
3. Structure
4. Scope
5. Funding/costs
6. Location
7. One central or one per CC?
8. Roles and functions
9. Vision
10. Time frame
11. Resources
12. Development process
13. Management structure
14. PYs to source
15. Level of integration
16. Virtual or real
17. Self-contained or distributed

C2 Laboratory: Creative solutions

1. ATM technologies
2. Video conferencing

3. Web pages
4. Training
5. Measure of effectiveness to evaluate payback
6. Field exercises
7. Virtual labs
8. High tech task forces
9. Allied initiatives
10. Analysis teams
11. Model development
12. Distributed lab
13. Simulation
14. Internet
15. Industry funding
16. Industry co-research
17. University co-research
18. Staff College co-research
19. Unified R&D lab
20. Incorporate doctrine and training
21. Use C2 lab for system integration
22. IV and V of new software and hardware
23. Start with tiger team - devolve to users
24. Co-exist new battle labs with existing test facilities

C2 Laboratory: Benefits

1. User involvement, feedback
2. Practical solution
3. Less duplication
4. More responsive
5. Better use of resources
6. Better communications between operators/developers
7. Test bed for private sector
8. High visibility
9. Focused effort
10. Better international leverage
11. Synergy
12. Fusion
13. More easily directed
14. Focus research
15. Confidence builder for operators
16. More timely solutions
17. Computer literate operators an express requirement and know technology
18. Better overall system integration

19. Proven system by operator and R&D community prior to fielding
20. Unified system
21. Users more familiar with systems
22. Reduces implementation risks in technical and schedule
23. Generates more and refines requirements

C2 Laboratory: Problems

1. Needs lots of resources
2. Control issues
3. Difficulty in establishing requirements baseline - creep
4. Difficult to capture resulting design in a spec that can be used for competitive procurement
5. Configuration management - battle lab vs. Operational system
6. Continuous training on battle lab system
7. Cost
8. Dislocation of present R&D staffs
9. Power play and politics between environments
10. Funding sharing
11. Too narrow a focus
12. Self serving, self centred, lack of imagination
13. Massive PY requirement
14. Too much overhead
15. Maybe too much emphasis on development and less on operations
16. Confusion as to who is the end user/owner
17. Scientists like to pursue pet projects

C2 Laboratory: Gut feeling

1. Excellent idea - a force multiplier
2. In C2, technology changes too rapidly; a C2 lab concept is needed
3. An essential part to system design and development
4. This could be an excellent tool for integration of all aspects of R&D (engineering, human factors, operations, doctrine, training, etc.)
5. It is time to have the C2 effort in one place
6. Would create synergy
7. Would compel us to greater levels of jointness
8. Essential for quick response and interoperability/integration issues
9. Excellent idea, but doubt the will is there to pay bills
10. Mandatory to ensure proper systems can be delivered within cost, schedule, risk and performance

CONCEPT C: MANAGEMENT

Management: Idea Base:

5. Cost (overhead) of team formation.
7. Should have more operational staff involvement in R&D.
9. CRAD as contract manager for R&D.
10. Devolution of R&D funding away from CRAD to client.
11. CRAD HQ co-located with users.
12. Evolutionary development process with no throw-aways.
15. How to balance need to maintain core competence vs. Maintaining flexibility to react to requirements.
17. New ways of managing R&D (new management structures).
20. Amalgamate all C2 research into one organization/ facility.
21. Establish a 'virtual' establishment with electronic linkages.
22. Greater interaction with allied/ international R&D to reduce potential for duplication of effort.
23. DREs do basic research, industry does applied research.
27. Revitalize CRAD by bringing in youngsters and renewing associations with universities.
28. Status quo.
34. Mutual education of team players (military education of scientists and vice versa).

Management: Information needs

1. Dry goals
2. Resources
3. Reporting relationships
4. Knowledge continuity
5. Vision
6. Strategic direction
7. Expertise
8. Management structure
9. Span of control
10. Skill levels
11. Career progression
12. Funding
13. Long term funding

Management: Creative solutions

1. Clear vision and leadership essential
2. Management must have appropriate skill and knowledge of area
3. Empowerment of management to do the necessary work
4. Multi-year commitment for funding with no arbitrary claw-backs
5. Change DPMS
6. Minimize bureaucracy
7. Allow carry over of funding to future FYs
8. Operational training for DS and engineers
9. Co-location or virtual office
10. Tiger teams
11. LO
12. Analysis teams
13. Devaluation of funding
14. Devaluation of responsibility
15. International industry involvement

Management: Benefits

1. Better use of resources
2. Confidence in end product
3. More timely solutions
4. More applicable/relevant solutions
5. Less duplication re industry/international
6. Better direction
7. Better morale
8. Concentrate efforts on R&D, not peripheral issues
9. Become more aligned with industry's priorities
10. Confidence/trust in managers
11. Fewer conflicting goals
12. More motivation and commitment by team members
13. Higher production
14. Consistent work output
15. Better awareness of senior management

Management: Problems

1. Micro-management potential
2. Lack of management training
3. Poor track record of management in general
4. Managers with inadequate experience
5. Divisive on team formation or cohesiveness

6. Lack of resources
7. Focus on long term problems
8. Posting cycle
9. Appraisal process of DS
10. Difficulty in building new core competency
11. Civilian/military differences
12. Bureaucratic
13. Morale
14. Apathy
15. Lack of focus
16. Lack of direction
17. Diluting control
18. Reduced effort
19. Duplication
20. Delegation of responsibility with proper training

Management: Gut feeling

1. Management is supposed to facilitate and expedite an agreed upon process - direction must come from above
2. Management is based upon senior direction, i.e., 'White Paper' should not be evaluated using scarce R&D funds
3. Change in management is needed. Existing is not working well
4. Management could use re-focus to go more joint
5. Always room for improvement. Must be careful to implement properly and then get on with job
6. More joint communication efforts required
7. Time to break up the 'rice bowls'

CONCEPT D: STRATEGIC DIRECTION

Idea Base:

3. Use training organizations for applied research.
6. Have R&D and engineering communities assist operational command in generating more complete requirements.
8. Leveraging off international and industrial activities.
10. Devolution of R&D funding away from CRAD to client.
11. CRAD HQ co-located with users.
12. Evolutionary development process with no throw-aways.
15. How to balance need to maintain core competence vs. Maintaining flexibility to react to requirements.

16. Focus R&D efforts towards meeting inputs for engineering specs and end-users timeline.
24. Education military community on need/ requirement for long-term research.
31. Statement of Deficiencies should be held in repository.
32. Same for Concept of Operations.
34. Mutual education of team players (military education of scientists and vice versa).
36. Force development community to provide steerage of R&D efforts.
37. Commitment by users to research ideas.

Strategic Direction: Information needs

1. Commanders' operations visions
2. Time home
3. Capability of targets
4. Resources
5. Steerage process
6. Interoperability with other nations and industry
7. Constraints
8. Relation to other activities
9. Future roles of CF
10. Capital plan as modified by budgets
11. Need to know what others are doing
12. Government/political approval
13. Public approval or buy-in

Strategic Direction: Creative solutions

1. Co-location of DS, operations and engineers
2. RTM technology
3. White Paper (or supplement) each year
4. Think tanks
5. Task force
6. Firm way-ahead
7. More defined development process
8. Environmental direction
9. Force structure model
10. Defined combat capability requirements
11. R&D staff involved with doctrine staff
12. Engineering involved doctrine staff
13. Technological way-ahead

Strategic Direction: Benefits

1. Provides much needed and essential high level direction
2. Reduced wasted effort
3. Ensures more accuracy in product
4. Engenders team building and sense of belonging
5. Reduces costs
6. Imposes consistency
7. Ensure configuration management
8. Completeness
9. Top priorities met first
10. Improved capabilities
11. Less R&D left on the shelf
12. Earlier feasibility
13. More efficient effective focus
14. Less duplication
15. Confidence
16. More relevant solutions
17. Risk reduction
18. Morale
19. Efficient use of resources
20. More timely delivery of research products
21. Stability of direction

Strategic Direction: Problems

1. Political and regional constraints
2. Painful process or reorganization
3. Too narrow a focus
4. Too short a vision
5. Financial constraints
6. Resources required to formulate SD and translate it into R&D objectives
7. Process takes too long
8. No feedback - doctrine gets out of date technologically
9. Less flexibility
10. Lack of independence
11. Political agendas

Strategic Direction: Gut feeling

1. CRAD needs to have direction to be able to achieve and C2 research the CF requires
2. An absolute necessity for best utilization or scarce resources

3. Essential to ensure way-ahead
4. Essential in an area of fast-changing technology
5. Lack of visionary strategic direction is one of the key reasons we have to undergo this brainstorming exercise.
6. Absolutely essential, but technology moves faster than doctrine or strategic direction
7. Most essential. Incomplete direction has resulted in deficient systems and problems during procurement

CONCEPT E: INFORMATION DISSEMINATION

Idea Base:

8. Leveraging off international and industrial activities.
11. CRAD HQ co-located with users.
13. CRAD/CF periodical written by scientists for military.
14. Mentor/patronage system for dissemination of results.
18. Analyze and model command requirements and develop best ways to present it to the commander.
21. Establish a 'virtual' establishment with electronic linkages.
22. Greater interaction with allied/ international R&D to reduce potential for duplication of effort.
24. Education military community on need/ requirement for long-term research.
29. Allow Defence Scientists to participate in field exercises.
30. Lessons learned from previous C2 systems.
31. Statement of Deficiencies should be held in repository.
32. Same for Concept of Operations.
33. Lab researchers work more closely with OR field stations.
34. Mutual education of team players (military education of scientists and vice versa).
35. Set up facilities joint with industry to do R&D and engineering testbeds, staffed by scientists, engineers, industry people to allow R&D to transition engineering prototypes with operator assessment.
38. This requires distribution of information.

Information Dissemination: Information needs

1. Who needs information (what information)
2. Security
3. How best to present
4. How to ensure it is read
5. Push/pull
6. Resources

7. Management - control
8. Timeliness
9. Accuracy
10. Credibility
11. Interoperable/user friendly information
12. Information technology capabilities
13. Use Internet technology for information exchange
14. Publishing
15. Detail requirements
16. Target guidance
17. Feedback

Information Dissemination: Creative solutions

1. Internet
2. Journals
3. Working groups
4. Seminars
5. Newsletters
6. Briefings
7. ITC
8. Reports
9. BBQs and beer
10. Visits
11. Demos
12. LOs
13. TDs
14. Staff courses/training
15. Study teams
16. Tiger teams
17. Document and system releasibility of multi-national R&D
18. Bilateral agreements
19. MOUs
20. Letters of Agreement
21. CRAD/CF publication on R&D results/issues
22. Unified R&D wide area network
23. Create web site
24. Interchange Canada - increase participation
25. Military to do thesis at DREs
26. Allow exchange of DS with universities
27. ATM link

Information Dissemination: Benefits

1. Awareness of capabilities/efficiencies, etc.
2. Lessons learned
3. Avoid re-creating the wheel
4. Avoid duplication of efforts
5. Better utilization of scarce resources
6. Wider span and use of knowledge base
7. Better advice
8. More informed decisions
9. Increased team production
10. Better corporate knowledge
11. Better understanding
12. Better feedback
13. Better direction
14. Reduced duplication
15. Greater focus
16. More effective
17. More efficient
18. Risk reduction
19. More responsive
20. Confidence
21. Better cost benefit analysis or trade-offs
22. Steerage
23. More achievable operational concepts
24. Greater use of technology developed by CRAD
25. Stimulates more requirements

Information Dissemination: Problems

1. Cost
2. Propriety rights
3. Security
4. Understanding
5. Narrow focus/apathy
6. Jargon too complex
7. Too many acronyms
8. Inappropriate distribution list
9. More reading (reduce productivity)
10. Interoperability of software
11. Too much garbage (and pet projects) distributed
12. Requires time to read, digest, etc.
13. Timeliness of information

14. No time to reflect on ideas
15. Too much information
16. Issues of need-to-know
17. Some information may be inaccurate

Information Dissemination: Gut feeling

1. More needed. Current initiatives may help if done properly
2. Very much needed to better use resources
3. Great way to reduce conflict
4. Creates team spirit
5. Great idea to achieve the information flow that appears to be lacking
6. Superb - a force multiplier
7. Must happen to ensure resource and funding efficiencies and common goals/aims
8. This is a potentially great way for creating corporate consensus on complex ideas
9. Great but we are still waiting for suitable links (T1, etc.) And interoperable applications (e-mail, word processors) which exist on the market

PRIORITIZATION

VOTING SUMMARY

	P1	P2	P3	P4	P5	P6	P7	P8
A. Organizational design	4	5	4	4	2	5	5	3
B. Command and Control laboratory	2	2	1	2	3	1	3	1
C. Management	3	4	5	3	5	4	4	4
D. Strategic direction	1	1	2	1	1	2	2	2
E. Information dissemination	5	3	3	5	4	3	1	3

AVERAGE RANK

	Average Rank
A. Organizational design	4.0
B. Command and Control laboratory	1.9
C. Management	4.0
D. Strategic direction	1.5
E. Information dissemination	3.4

ANNEX D
ORD PROJECT REPORT PR9621
DECEMBER 1996

SYNDICATE 2D: PROCESSES AND STRUCTURES

INTRODUCTION

D-1. Session 2 consisted of all six syndicate groups examining the same question:

"What structures and processes should be put in place to establish a team approach to C2 R&D in the department that will meet the current and future needs of the CF?"

Syndicate 2D developed 33 ideas which were grouped into the following 6 concepts:

a. Personnel development and management;

b. Creativity (external);

c. Interactive teams;

d. Requirements;

e. Structure; and

f. Information management and dissemination.

D-2. The following format is used in documentation. For each concept:

a. Idea base for each concept (generated via the Nominal Group Technique);

b. Idea development for each concept (generated via Ideawriting and the Six Thinking Hats):

(1) Information needs;

(2) Creative solutions;

(3) Benefits;

(4) Problems; and

(5) Gut feelings;

c. Prioritization (syndicate member votes):

(1) Voting summary (anonymous vote matrix); and

(2) Consensus Decision Support Program (CDSP) computer program analysis.

D-3. Voting results were tabulated. Results and average ranks appear at the end of this annex. This syndicate assessed concepts in the following order of priority:

a. Interactive teams (Concept C),

b. Personnel development and management (Concept A);

c. Structure (Concept E);

d. Creativity (Concept B);

e. Requirements (Concept D); and

f. Information management/ dissemination (Concept F).

IDEA INVENTORY

1. Role evaluation and assignment (with review).
2. Operator 'help desk' organization.
3. Command/ Battle lab.
4. CRAD report to VCDS.
5. Focal point for INT/EXP liaison.
6. Response to evolving requirements.
7. Closer C2IS R&D community.
8. Integrated process teams (tiger teams).
9. Common knowledge base.
10. Marketing.
11. CF lab postings.
12. CRAD field postings.
13. Joint concept development.
14. Prototyping to define requirements.
15. Joint standards (CRAD and CF environments).
16. Commercial R&D process.
17. Postings with industry.
18. Project management team located in labs.
19. Exchanges with industry and universities.
20. Active CF participation in experiments (C2).
21. Adaptive training facilities.
22. Integrated development operational and training facility.
23. Senior officer involvement.
24. Refinement of acquisition process.
25. CRAD personnel in Project Management offices.
26. Training courses for military and civilians.
27. More dedicated trials time.
28. Dedicated technology watches.
29. More foreign lab postings.
30. CRAD to seek OGD work (C2IS).
31. Scientist comm. demographics and terms of reference.
32. Capture creative ideas of non-tech personnel.
33. Rewards for innovation.

CONCEPT A: PERSONNEL DEVELOPMENT AND MANAGEMENT

Idea Base:

3. Command/ Battle lab.
6. Response to evolving requirements.
7. Closer C2IS R&D community.

11. CF lab postings.
12. CRAD field postings.
17. Postings with industry.
19. Exchanges with industry and universities.
25. CRAD personnel in Project Management offices.
26. Training courses for military and civilians.
29. More foreign lab postings.
31. Scientist comm. demographics and terms of reference.
33. Rewards for innovation.

Information needs

1. Personnel inventory
2. Career progression
3. Job functions
4. Computer network architecture
5. Job training
6. Infrastructure inventory characteristics
7. Industry equivalents to DS
8. Job inventory
9. Terms of service
10. Individual desires
11. Other military/industrial examples
12. Effect on CF core roles and mission (how much does it cost in people?)
13. Posting and allowance cost

Creative solutions

1. Personnel rotation
2. Shorter term of service
3. Self-advertising
4. Rewards programme
5. Cross CF and R&D personnel training
6. Train some scientists to become operators, then return to technical community
7. Post operators into R&D labs with training to do some limited R&D work
8. Exchanges with industry, universities and other foreign research labs
9. Heads of labs be administrators from outside DS community

Benefits

1. Greater understanding between user and developer of each other
2. Less misunderstandings
3. Increased confidence of system and people

4. Happier people
5. Common goals
6. Broader tool sets
7. Greater commitment to corporate goals
8. Allows for R&D interaction throughout project lifetime
9. Greater flexibility to meet changing user requirements

Problems

1. Cost in dollars and PYs and families
2. Lose people to industry
3. Career implications
4. Implications for the organization
5. Morale implications
6. Allies, OGDs, industry, may be unwilling to reciprocate
7. Legal minefield (IPR)
8. Potential loss of continuity
9. Too expensive

Gut feeling

1. Great idea!
2. Could be very productive!!
3. Absolutely necessary for team building
4. Why are we so late in fixing this obvious shortcoming!
5. Should have been emphasized long ago
6. Mandatory
7. Career implications for operators

CONCEPT B: CREATIVITY

Idea Base:

3. Command/ Battle lab.
6. Response to evolving requirements.
8. Integrated process teams (tiger teams).
11. CF lab postings.
12. CRAD field postings.
16. Commercial R&D process.
17. Postings with industry.
19. Exchanges with industry and universities.
26. Training courses for military and civilians.

28. Dedicated technology watches.
29. More foreign lab postings.
32. Capture creative ideas of non-tech personnel.

Information needs

1. Knowledgeable individuals (internally)
2. Senior management buy-in
3. Open minded internal individuals
4. Financial constraints
5. Mutual benefits
6. Inventory of potential sources
7. Mechanism to obtain their services/knowledge
8. Facilitators
9. Knowledge agents
10. Study innovation - draw lessons

Creative solutions

1. Contract think-tank agencies (RAND, DARPA, Etc.)
2. Hire Hollywood/Vancouver
3. Expanded circulation of trip reports
4. Training and testing facilities
5. Technology initiative games
6. Encourage 'net' surfing and networking

Benefits

1. Fresh ideas internally
2. New information externally
3. Feed-back co-operation established
4. Fosters partnership with industry
5. Expands horizons
6. Personnel development
7. Improved utilization of resources
8. Maintains departmental currency
9. Fosters concepts development
10. Better product
11. May uncover hidden solution
12. Benefits external and internal participants

Problems

1. Continuation of thinking inside the box
2. Loss of innovation
3. Increased costs
4. Danger of lowering morale in inherent organization
5. May lead to loss of 'creative' personnel
6. May lead to low morale because problem of implementing creative solutions
7. Potential loss of id
8. Potential poor returns
9. Going on a wild-goose chase

Gut feeling

1. Agree - we must look outside current environment for novel solutions
2. Can work but need constant effort or will die
3. A must, too much old book in ideas (not people!)
4. Must do to create a better and more affordable product
5. Implement as soon as possible
6. Go for it!!
7. Hear, hear!!!!!

CONCEPT C: INTERACTIVE TEAMS

Idea Base:

1. Role evaluation and assignment (with review).
5. Focal point for INT/EXP liaison.
6. Response to evolving requirements.
7. Closer C2IS R&D community.
8. Integrated process teams (tiger teams).
11. CF lab postings.
12. CRAD field postings.
13. Joint concept development.
14. Prototyping to define requirements.
17. Postings with industry.
19. Exchanges with industry and universities.
20. Active CF participation in experiments (C2).
21. Adaptive training facilities.
22. Integrated development operational and training facility.
27. More dedicated trials time.
28. Dedicated technology watches.

Information needs

1. Expertise and experience of individuals
2. Identification of knowledge shortfalls
3. Time limitations of team
4. Documentation of team concepts
5. Identification technology sources
6. Initial list of targets of opportunity
7. Common skill development (e.g. PM courses)
8. Idea generation
9. Common language (technical equivalent, not linguistic)
10. Co-location of teams/physical infrastructure
11. Cost-benefit
12. Implementation strategy
13. Government guidelines (PWGSC)

Creative ideas

1. Tiger team involving scientists, engineers and operators
2. Privatize entire R&D process
3. Induction of DSS into CF reserves
4. Offer services to industry, universities, allies, OGDs
5. Video conferencing - virtual teams
6. Attaché postings - less than 6 months
7. Team required from cradle to grave

Benefits

1. Better end product
2. Faster implementation
3. Low life cycle costs
4. Increased operator confidence
5. Morale booster
6. Focus R&D effort
7. Helps support evolution of products
8. Synergism from team

Problems

1. Overabundance of information/knowledge
2. Takes operators away from operations
3. Negative impact on scientists' careers

Gut feeling

1. Beneficial
2. Very beneficial
3. Operator community may balk because of career implications
4. Done to some degree already but this could be a big step forward for some programs
5. Benefits will outweigh effort required in long run
6. Must be implemented to the fullest extent for C2 R&D to benefit
7. Personal experience says this will work, why is this not a standard

CONCEPT D: REQUIREMENTS

Idea Base:

3. Command/ Battle lab.
5. Focal point for INT/EXP liaison.
6. Response to evolving requirements.
9. Common knowledge base.
13. Joint concept development.
14. Prototyping to define requirements.
15. Joint standards (CRAD and CF environments).
23. Senior officer involvement.
24. Refinement of acquisition process.

Information needs

1. Concepts definition
2. Equivalent programs
3. Interoperability
4. Commercial standards
5. Environmental constraints
6. Time frame
7. Financial constraints
8. Evaluation (trial)
9. Reliability
10. Information on similar projects
11. Identification of priorities

Creative solutions

1. Rapid prototyping / battle lab
2. Brainstorming

3. Interactive teams
4. Use commercial technology
5. Incentive (pay, leave, etc.) for suggestions and requirements
6. Joint-concepts teams
7. Joint requirement definition teams
8. Hiring external consultants for requirement definition

Benefits

1. Better product
2. Faster implementation
3. Lower costs
4. More complete capture
5. User has a greater feeling of ownership
6. R&D personnel have greater pride in product

Problems

1. Requirement definition is difficult and time-consuming
2. Error prone
3. Personnel-dependent (biases)
4. Requires educational investment
5. Overwhelming number of requirements

Gut feeling

1. Could be implemented easily if senior management buy-in is a reality
2. Too fuzzy but there are possibilities/needs more work
3. Let's stop talking about it and do it
4. Command lab concept is an ideal vehicle
5. Good if not overdone
6. We're good enough at this, let's put our energy into other parts of the problem

CONCEPT E: STRUCTURE

Idea Base:

1. Role evaluation and assignment (with review).
2. Operator 'help desk' organization.
3. Command/ Battle lab.
4. CRAD report to VCDS.
5. Focal point for INT/EXP liaison.
6. Response to evolving requirements.

7. Closer C2IS R&D community.
9. Common knowledge base.
18. Project management team located in labs.
21. Adaptive training facilities.
22. Integrated development operational and training facility.
23. Senior officer involvement.
24. Refinement of acquisition process.
25. CRAD personnel in Project Management offices.
30. CRAD to seek OGD work (C2IS).

Information needs

1. Current capability
2. Government regulations/policy
3. Well defined deliverables
4. Personnel issues
5. Identification of shortfalls of current structure (OGDs, allies)
6. Identification of advantages of current structure
7. Investigations of other structures
8. Battle lab
9. Command relationships
10. Siting implications (internal and external)

Creative solutions

1. 'Command lab' training and concept development and testing facility
2. Move CRAD out of ADM(Mat)
3. Combine all labs into a super lab in Kingston
4. Completely new organization
5. Move R&D to commands

Benefits

1. Less bureaucracy
2. Lower costs
3. Quicker implementation
4. Better liaison
5. Happier people
6. Insures correct priorities are met
7. Encourages liaison with allies and OGDs
8. Mitigates bureaucracy and process
9. Should speed things up

Problems

1. Short term disruption
2. Negative effects on morale
3. Overhead cost increases
4. Results could be bad
5. OGDs may not want CRAD
6. Potential loss of capability with untried structure
7. Same old crap no matter how you slice it!

Gut feeling

1. Some restructuring within reason
2. Definition of 'structure' not precise enough - fuzzy
3. Appropriate use Of CRAD resources and empire is a must
4. This is minimum needed if CRAD is to retain relevance in this area of technology
5. We could reorganize 100 times and things wouldn't change much
6. Fuzzy but there has to be a better understanding of who is doing what, etc.
7. Clearly some optimization is available here

CONCEPT F: INFORMATION MANAGEMENT AND DISSEMINATION

Idea Base:

2. Operator 'help desk' organization.
3. Command/ Battle lab.
5. Focal point for INT/EXP liaison.
7. Closer C2IS R&D community.
9. Common knowledge base.
10. Marketing.
15. Joint standards (CRAD and CF environments).
18. Project management team located in labs.
23. Senior officer involvement.
25. CRAD personnel in Project Management offices.
27. More dedicated trials time.
28. Dedicated technology watches.
29. More foreign lab postings.

Information needs

1. User community and needs
2. Security constraints

3. Currency
4. International exchanges
5. Marketing expertise
6. Communication skills
7. Communication means
8. Data collection and analysis plan

Creative solutions

1. Study commercial successes (Federal Express, + Allies, OGDs)
2. Distributed databases (redundancy)
3. Commercial IT standards
4. Direction from senior management to implement
5. Creation and exploitation of e-networks
6. Hire professional communicators
7. Issue everyone in CF a Personal Digital Assistant
8. Internet or one CF network availability for entire force
9. C2 website - data for and data from 'surfers'
10. DND intra-net for R&D issues
11. Development of 'data mining' techniques and data bases

Benefits

1. Fosters teamwork
2. Encourages common standards of interoperability
3. Personnel development
4. Synergism (iterative)
5. Avoids duplication
6. Encourages efficient use of resources
7. Prioritization of problems
8. Less TD, improve morale, information moves not people
9. Increased education
10. Limits loss of required information
11. Common location for user to find information
12. Reduce frustration in finding things
13. Reduce duplication of effort

Problems

1. Another DISO empire
2. Micro-management
3. Expensive (dollars and people)
4. Security of information at risk

5. Loss of personnel interaction (man in the loop)
6. Oversold
7. Loss of focus on problems at hand

Gut feeling

1. Won't work
2. Very tricky - will be extremely difficult
3. Some ideas may work but could cost lots of dollars and PYs
4. Good idea to create team atmosphere without actually bringing people together
5. One has to be very careful here - lots of potential but also lots of negative potential
6. Mandatory
7. Very risky - must be well thought out

PRIORITIZATION

VOTING SUMMARY

	P1	P2	P3	P4	P5	P6
A. Personnel dev & management	2	2	3	1	3	2
B. Creativity	5	5	2	4	4	3
C. Interactive teams	3	3	1	2	2	1
D. Requirements	4	4	6	6	6	4
E. Structure	1	1	5	3	1	5
F. Info management/ dissemination	6	6	4	5	5	6

AVERAGE RANK

	Average Rank
A. Personnel dev & management	2.2
B. Creativity	3.8
C. Interactive teams	2.0
D. Requirements	5.0
E. Structure	2.7
F. Info management/ dissemination	5.3

ANNEX E
ORD PROJECT REPORT PR 9621
DECEMBER 1996

SYNDICATE 2E: PROCESSES AND STRUCTURES

INTRODUCTION

E-1. Session 2 consisted of all six syndicate groups examining the same question:

"What structures and processes should be put in place to establish a team approach to C2 R&D in the department that will meet the current and future needs of the CF?"

Syndicate 2E developed 43 ideas which were grouped into the following 5 concepts:

a. Establish Research & Development & Procurement;

b. Establish Battle-Labs;

c. Develop/establish teams;

d. Improve communications; and

e. General principles/Basic necessities.

E-2. The following format is used in documentation. For each concept:

a. Idea base for each concept (generated via Nominal Group Technique);

b. Idea development for each concept (generated via Six Thinking Hats):

(1) Information needs;

(2) Creative solutions;

(3) Benefits;

(4) Problems; and

(5) Gut feelings;

c. Prioritization (syndicate member votes):

(1) Voting summary (anonymous vote matrix); and

(2) Consensus Decision Support Program (CDSP) computer program analysis.

E-3. Voting results were tabulated. Results and average ranks appear at the end of this annex. This syndicate assessed concepts in the following order of priority:

a. Research & Development & Procurement Paradigm (Concept A);

b. Develop and establish teams (Concept C);

c. Battle Labs (Concept B);

d. Improve communications (Concept D); and

e. General principles/ Basic necessities (Concept E).

IDEA INVENTORY

1. Collocation of R&D with key industries.
2. Partnership between: labs/industry/client.
3. Collapse the time scale (DPMS).
4. Collocation of ideas (WWW).
5. Use battle-lab concept.
6. Integrated product team.

7. Keep operator in loop from start.
8. Concentrate on next generation.
9. Joint training (R&D/operators).
10. Use buy & try more.
11. Federal government budget cycle.
12. Research is a necessity to do development and procurement.
13. Continual update of threat analysis.
14. Evolutionary implementation.
15. Open-ended architectures.
16. Improve scientists understanding of user requirements.
17. Joint development and procurement of new R&D capability.
18. Harmonization of R&D and procurement.
19. DND focus on 'R'; industry on 'D'.
20. Ensure keep benefits of relationships with peers.
21. Complementary/ Co-operative R&D (with US).
22. IOC and FOC are obsolete concepts.
23. Do as many processes in parallel as possible.
24. Keep watch on research in universities.
25. Virtual labs and simulators.
26. Training and support to maintain operator interest.
27. Level One business plans should include R&D.
28. Single corporate vision and mission.
29. R&D component in life-cycle funding.
30. Merged acquisition and R&D processes.
31. Allow teams to change and evolve.
32. Copy of C2I systems to R&D community.
33. Cross CC distribution of R&D results.
34. More R&D involvement in procurement process.
35. Merge Test Facility and DRE's.
36. Technology insertion process for fielded systems.
37. Database of C2I players requirements and systems.
38. Centres of excellence.
39. More R&D workshops involving users.
40. 'Tiger teams' for quick fixes.
41. Configuration control (joint).
42. 'Gestation' scientist - conception to birth.
43. Allow for quick kill of ideas/projects.

CONCEPT A: ESTABLISH RESEARCH & DEVELOPMENT & PROCUREMENT PARADIGM

Idea Base:

2. Partnership between: labs/industry/client.
3. Collapse the time scale (DPMS).
5. Use battle-lab concept.
7. Keep operator in loop from start.
8. Concentrate on next generation.
11. Federal government budget cycle.
12. Research is a necessity to do development and procurement.
14. Evolutionary implementation.
15. Open-ended architectures.
18. Harmonization of R&D and procurement.
22. IOC and FOC are obsolete concepts.
23. Do as many processes in parallel as possible.
29. R&D component in life-cycle funding.
30. Merged acquisition and R&D processes.
31. Allow teams to change and evolve.
34. More R&D involvement in procurement process.
35. Merge E. Test Facility and DRE's.
36. Technology insertion process for fielded systems.
40. 'Tiger teams' for quick fixes.

R&D&P Paradigm: Information needs

1. Current DPMS process
2. Understand C2IS goals/direction/doctrine/mission
3. Technology (science) trends and analysis
4. What is full team for evolution
5. How to break current expectations of existing process

R&D&P Paradigm: Creative solutions

1. Integrate R&D staff with procurement team
2. Shrink timeline for DPMS approval cycle
3. Change the top!
4. Adapt Treasury Board 'quick bite' process
5. CRAD representative on program management staff
6. Fund R&D for life cycle
7. Life cycle plan should incorporate system evolution
8. Be open to new technologies

9. Involve R&D staff with project documentation
10. Involve project staff with R&D

R&D&P Paradigm: Benefits

1. Compress delivery time for solutions
2. Allows for changes in technology
3. More effective technology insertion
4. More practical field deployment
5. Save money and resources - more effective and efficient
6. No longer have stove-pipe solutions
7. Longer-lived systems
8. Gradual evolution simplifies funding cycle
9. Lower cost over time
10. Reduces risk of new technology insertion
11. Eliminates stagnation
12. Improve user acceptance of technology

R&D&P Paradigm: Problems

1. Disconnect from current funding mechanism
2. Mistrust
3. Lack of support for projects
4. Growing pains during transition
5. Turf battles
6. Bureaucracy
7. No leadership from top - too conservative!
8. Politically incorrect
9. Lack of conceptual understanding may lead to inappropriate solution
10. Costly if never an end-point
11. May lose track of real world
12. Costly training updates

R&D&P Paradigm: Gut feelings

1. Much needed but very difficult to do
2. Takes lots of dedicated effort
3. DND will never buy it!
4. Much needed but a lot of political inertia
5. Has to be done! (or we are out of business)
6. Must be done right

CONCEPT B: ESTABLISH BATTLE-LABS

Idea Base:

4. Collocation of ideas (WWW).
5. Use battle-lab concept.
7. Keep operator in loop from start.
9. Joint training (R&D/operators).
10. Use buy & try more.
15. Open-ended architectures.
25. Virtual labs and simulators.
32. Copy of C2I systems to R&D community.
36. Technology insertion process for fielded systems.
38. Centres of excellence.

Establish Battle-Labs: Information needs

1. Current doctrine
2. Likely ops/breadth of employment
3. Co-location or distributed - communications link + bandwidth!
4. Who are the customers/partners; releasibility
5. Lab participants
6. Interoperability requirements
7. Links to external labs/system (e.g., Connect to us lab)
8. Training
9. Multiple or single lab concept
10. How to connect multiple labs
11. Equipment necessary for battle labs
12. Security necessary for battle labs
13. Configuration control
14. Procurement process
15. Test and evaluation methodology
16. Interoperability
17. Test scenarios

Establish Battle-Labs: Creative solutions

1. Establish battle lab
2. Small, specific applications lab
3. Virtual lab (distributed)
4. One big lab
5. Multiple battle labs (CCs and R&D communities)
6. Multiple platforms (for variety)

7. Interconnect on technology
8. Dispersed in various DREs, industry, operational headquarters
9. Interoperable architecture
10. Permanent battle lab support staff

Establish Battle-Labs: Benefits

1. In the field faster
2. Operator has already 'bought in' to solution
3. Scientist/officer respect/understanding enhanced
4. Requirements better met and defined
5. Assists in system evolution
6. Interoperability check before fielding
7. Improved training
8. More efficient use of systems
9. Cost effective
10. Risk reduction
11. Better understanding of user requirements
12. Better user exposure to technologies
13. Support new doctrine
14. Faster technology insertion
15. Team training and simulation
16. Less field problems

Establish Battle-Labs: Problems

1. Too costly - H/W, S/W, tech
2. If communications links fail, disaster happens
3. More posting
4. May not be faithful to 'real world'
5. May develop a rigid solution
6. May prevent new ideas/solutions
7. May divert effort from fielding system
8. Dependent on available/resident expertise

Establish Battle-Labs: Gut feelings

1. The way to go
2. Good concept with drawbacks
3. This is a key part of solution (but needs the other components)
4. Worth trying to make work but don't view in isolation
5. Easier said than done
6. Best bang for the buck

CONCEPT C: DEVELOP/ESTABLISH TEAMS

Idea Base:

1. Collocation of R&D with key industries.
2. Partnership between: labs/industry/client.
4. Collocation of ideas (WWW).
6. Integrated product team.
7. Keep operator in loop from start.
9. Joint training (R&D/operators).
14. Evolutionary implementation.
16. Improve scientists understanding of user requirements.
17. Joint development and procurement of new R&D capability.
19. DND focus on 'R'; industry on 'D'.
26. Training and support to maintain operator interest.
31. Allow teams to change and evolve.
32. Copy of C2I systems to R&D community.
35. Merge Test Facility and DRE's.
38. Centres of excellence.
40. 'Tiger teams' for quick fixes.

Develop/Establish Teams: Information needs

1. Team objectives
2. Team missions
3. Team goals
4. Team (potential) members
5. Member experiences/skill sets/expertise/background
6. Desire team mixes
7. Team interaction processes and mechanisms
8. Should teams be permanent or mission operated
9. What is the best team mix
10. Who should guide teams
11. Funding (money, people, equipment)
12. Team support structures

Develop/Establish Teams: Creative solutions

1. Integrated procurement teams with industry, CRAD, operators, US, PM
2. Tiger teams
3. Battle lab concept
4. 'Virtual' team (distributed vice co-located)
5. Cross service teams

6. Internet teams
7. De-centralized control
8. Temporary teams
9. Flexible teams
10. Networked teams
11. Early buy-in by all team members
12. Joint training
13. Common vision development
14. Permit risk management
15. Retain benefits/ not return to centre

Develop/Establish Teams: Benefits

1. Better product
2. Better communication
3. Lower cost
4. Reduced time frame
5. More satisfied users
6. Improved interoperability
7. Better, more complete solutions
8. Better ability to handle diverse problems
9. Pooling of resources
10. Risk reduction
11. User buy-in
12. More cost effective use of R&D effort
13. Better inter-service operation
14. Human-human interaction leads to faster solution
15. Quick start
16. Synergism

Develop/Establish Teams: Problems

1. Committee phenomenon (slows process)
2. Leadership problems
3. Logistical difficulties
4. Communication hurdles
5. Continuity
6. Team might become an entity unto itself and forget key goal
7. More discussion than action is possible
8. Delay in reaching consensus
9. Industry will balk
10. Bureaucracy
11. More training

12. Limits flexibility
13. Co-ordination difficult
14. Will stop individual initiatives
15. Slow process

Develop/Establish Teams: Gut feeling

1. Industry is going this route, so it must be cost effective and beneficial
2. Need operators in loop
3. If all good components (i.e. People) are involved, the outcome should be optimal
4. Operator involvement is essential
5. Very critical
6. Need training on team building for success
7. Easier said than done but essential
8. Some government rules will prevent effective implementation

CONCEPT D: IMPROVE COMMUNICATIONS

Idea Base:

4. Collocation of ideas (WWW).
6. Integrated product team.
7. Keep operator in loop from start.
13. Continual update of threat analysis.
16. Improve scientists understanding of user requirements.
17. Joint development and procurement of new R&D capability.
33. Cross CC distribution of R&D results.
37. Database of C2I players requirements and systems.
39. More R&D workshops involving users.

Improve Communications: Information needs

1. Who needs information
2. What needs to be communicated
3. How to best communicate - what techniques are available
4 Is there a need for security?
5. Distribution methods (e.g., Internet)
6. Database of C2I organizations and workers (include non-defence organizations)
7. Information sources
8. Information consumers

Improve Communications: Creative solutions

1. Use Internet
2. Have workshops/seminars
3. Establish informal lines of communication
4. Have a database of existing systems and projects and people involved
5. Make teams fluid
6. Allow cross service
7. R&D program summaries on wide distribution
8. Copy R&D prototypes to battle labs
9. DREnet connection DND WAN (MAN/LAN)
10. Establish centralized C2IS data base of requirements, systems and users
11. More R&D workshops
12. R&D Internet

Improve Communications: Benefits

1. More effective systems
2. More personnel involved, therefore more ideas and variety
3. Less duplication of effort
4. Cross-fertilization
5. Common vision
6. Better buy-in by team members
7. More support from operators
8. Wider use of common technology
9. More forward looking user
10. Military owners feel participants
11. Synergism
12. Reduced cost
13. Better understanding by scientists of user situation and vice versa

Improve Communications: Problems

1. Too much time spent discussing rather than doing
2. Might not work if hierarchy needs are still in place
3. Too much effort on 'pr'
4. Duplicate distribution of information
5. Confusion
6. Increased workload
7. Expensive re communications infrastructure
8. Too much 'navel gazing'
9. User will want to buy all the 'toys'

Improve Communications: Gut feeling

1. Critical
2. Essential to well developed systems
3. Avoid misuse and make sure project is actually done
4. Should be easy to do
5. Not as easy as it appears!
6. Cannot afford what we need to make it happen
7. Cannot afford <u>not</u> to make it happen!

CONCEPT E: GENERAL PRINCIPLES/ BASIC NECESSITIES

Idea Base:

12. Research is a necessity to do development and procurement.
20. Ensure keep benefits of relationships with peers.
21. Complementary/ Co-operative R&D (with US).
24. Keep watch on research in universities.
27. Level One business plans should include R&D.
28. Single corporate vision and mission.
32. Copy of C2I systems to R&D community.
33. Cross CC distribution of R&D results.
37. Database of C2I players requirements and systems.
39. More R&D workshops involving users.
41. Configuration control (joint).
42. 'Gestation' scientist - conception to birth.
43. Allow for quick kill of ideas/projects.

General Principles: Information needs

1. Workshops/seminars - both Canadian and International
2. E-mail/Internet
3. Secure networking with partners
4. Follow them! (separate session needed to establish)
5. All current requirements/users/systems
6. All current configurations
7. All planned systems/requirements
8. Business plan
9. What are they?
10. How do we adhere to them?
11. Remain open to new concepts

General Principles: Creative solutions

1. Basic training in R&D methods for DND team
2. Link principles with Level One business plans
3. Go/No Go milestones
4. No penalty for false leads ('kill' does not imply loss of resources)
5. Implement 'quick kill' process
6. Establish joint C2IS configuration control board

General Principles: Benefits

1. Again, be open to new ideas and methods
2. Allow for informal communications lines (encourage them, make them easier)
3. More effective R&D&P
4. Lessons learned
5. More synergism
6. More efficient use of limited resources (dollars)
7. Conception to birth effectiveness of fielded solution

General Principles: Problems

1. Have to relearn lessons
2. Waste R&D effort
3. Miss opportunities for use of new technology
4. Indulgence in 'R' - development may not follow
5. Motherhood
6. We already do it
7. Too expensive
8. Resistance to change (rigid organization)

General Principles: Gut feeling

1. Must follow these at every opportunity
2. Important to get user buy-in
3. Motherhood
4. Should be included in vision statement
5. Don't tell me we don't already follow these?

PRIORITIZATION

VOTING SUMMARY

	P1	P2	P3	P4	P5	P6	P7	P8
A. Establish R&D&P Paradigm	4	1	1	1	2	4	1	1
B. Establish Battle-Labs	2	2	2	2	4	1	4	3
C. Develop/Establish teams	1	3	3	3	1	3	2	2
D. Improve Comms.	3	4	4	4	3	2	3	4
E. General principles/ Basic necessities	5	5	5	5	5	5	5	5

AVERAGE RANK

	Average Rank
A. Establish R&D&P Paradigm	1.9
B. Establish Battle-Labs	2.5
C. Develop/Establish teams	2.3
D. Improve Comms.	3.4
E. General principles/ Basic necessities	5.0

SYNDICATE 2F: PROCESSES AND STRUCTURES

INTRODUCTION

F-1. Session 2 consisted of all six syndicate groups examining the same question:

"What structures and processes should be put in place to establish a team approach to C2 R&D in the department that will meet the current and future needs of the CF?"

Syndicate 2F developed 46 ideas which were grouped into the following 5 concepts:

a. Business Planning/ Delivery Strategy

b. Teaming;

c. Sharing/Leveraging/Synergism;

d. Support services/Facilities; and

e. Expertise/Education

F-2. The following format is used in documentation. For each concept:

a. Idea base for each concept (generated via the Nominal Group Technique);

b. Idea development for each concept (generated via Ideawriting and the Six Thinking Hats):

(1) Information needs;

(2) Creative solutions;

(3) Benefits;

(4) Problems; and

(5) Gut feelings;

c. Prioritization (syndicate member votes):

(1) Voting summary (anonymous vote matrix); and

(2) Consensus Decision Support Program (CDSP) computer program analysis.

F-3. Voting results did not appear to indicate group consensus. The data was also analyzed using a computer-based consensus analysis program. A statistically significant degree of consensus was *not* found in the votes recorded for this syndicate group. Results and average ranks appear at the end of this annex.

IDEA INVENTORY

1. DREA model (co-location, integration).
2. Integrate whole process (Testing & Evaluation, engineering, team, doctrine, requirements capture, final delivery).
3. Near-term/long-term goals.
4. Shorten life-cycle/delivery.
5. Ensure SM commitment.
6. Bound R&D and implementation.
7. Incremental fielding approach (UK model).
8. Integrate R&D with requirements.
9. Multi-disciplinary teams.
10. Common environment (engineering, research, operators, exercise).
11. Decouple processes from budget cycles.
12. Cross-pollination across services, countries.
13. Reduce code duplication (modularity).
14. Co-ordinate R&D with allies.
15. Capture client feedback.

16. Rapid prototyping in phases.
17. Evolutionary spiral development model.
18. Common user core.
19. Improved awareness/education in fielding prototypes.
20. Review of common goals.
21. Build stakeholder ownership of process.
22. Early industry involvement.
23. Protect/capture knowledge base.
24. Post scientist in ops..
25. Stimulate competitive R&D.
26. Scientist on military conferences/courses.
27. Military on scientific conferences/courses.
28. Role for universities/centres of excellence.
29. Military in labs.
30. Focus on the future.
31. Battle labs.
32. Allocate resources to small/medium/long term research and problem resolution.
33. Maintain techbase capability/continuity.
34. Protect government expertise (with respect to downsizing).
35. Military postgrads to scientific positions (R&D).
36. International exchange scientist/military.
37. Test/evaluate in LIVEX.
38. Project life cycle posting.
39. Business planning/case.
40. Target/select C2 R&D.
41. Measure gains (MOEs, MOPs).
42. Cost sharing with industry (leveraging/alliances/ partnering).
43. "Have a beer together".
44. Integrated analysis/design/development.
45. Open requirements to industry.
46. Flexible/streamline, shorten/contracting process.

CONCEPT A: BUSINESS PLANNING/ DELIVERY STRATEGY

Idea Base:

1. DREA model (co-location, integration).
2. Integrate whole process (Testing & Evaluation, engineering, team, doctrine, requirements capture, final delivery).
3. Near-term/long-term goals.
4. Shorten life-cycle/delivery.
5. Ensure SM commitment.

6. Bound R&D and implementation.
7. Incremental fielding approach (UK model).
8. Integrate R&D with requirements.
9. Multi-disciplinary teams.
10. Common environment (engineering, research, operators, exercise).
11. Decouple processes from budget cycles.
14. Co-ordinate R&D with allies.
15. Capture client feedback.
16. Rapid prototyping in phases.
17. Evolutionary spiral development model.
18. Common user core.
20. Review of common goals.
21. Build stakeholder ownership of process.
22. Early industry involvement.
25. Stimulate competitive R&D.
30. Focus on the future.
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40. Target/select C2 R&D.
41. Measure gains (MOEs, MOPs).
42. Cost sharing with industry (leveraging/alliances/ partnering).
44. Integrated analysis/design/development.
46. Flexible/streamline, shorten/contracting process.

Business Planning: Information needs

1. Define SOR/resources - dollars, personnel/goals
2. Define delivery process
3. Define mid-near-long term goals/milestones (conceptual and actual)
4. Identify partners/stakeholders (responsibilities and authorities)
5. Define technical/operational constraints (infrastructure, standards {data/IT/IM})
6. Budget
7. Define special facilities
8. Co-ordinate internal/external policies
9. Contingency funds for the unexpected

10. Education/training planning
11. Implementation plan
12. Review procedures
13. Metrics
14. Alliances (CF/industry/academia/internal/external)
15. Deliverables
16. Technology trends
17. Task breakdown
18. Schedule/milestones
19. Requirements
20. Resources
21. Process
22. Integrated approach

Business Planning: Creative solutions

1. Living document/plan
2. Single departmental R&D master plan
3. Balance short/medium/long-term projects
4. Stakeholders approve business plan
5. Create at the very beginning a team approach (requirement, R&D, T&E, engineering, fielding)
6. Stake holders
7. Define and focus on a goal
8. End product approach
9. New sources of funding
10. Partnership
11. Spiral model
12. Cost recovery
13. Use
14. Enforce team approach in industry - team that markets/develops concepts must be the same personnel for development and fielding of project (continuity)
15. Near/mid/long term

Business Planning: Benefits

1. Accountability - penalties
2. Visibility of resources
3. Visibility of work
4. Trace requirements to deliverable
5. Identify roles and responsibility
6. Define delivery process and deliverables and milestones

7. Provides continuity
8. Integrated approach
9. Matches product to delivery requirement
10. Shorter delivery time
11. Newest technology fielded (advantage for own forces)
12. Anticipation of problems
13. Improve reaction to unforeseen difficulties
14. Focus of effort is better
15. Commitment of senior management/user
16. Facilitates prioritization of R&D
17. Ensures project visibility
18. Provides basis for MOEs

Business Planning: Problems

1. Painful for middle and senior management
2. Time consuming
3. Expensive
4. Not suited to 'operational cost/benefit' (cannot be quantified)
5. Requires administrative overhead
6. Takes managers away from managing and scientists away from the lab
7. Time consuming to make the plan and assemble the team and get approval
8. Interference/political issue
9. Risk of being too ambitious
10. Over-complexity
11. Cost constraints can kill the plan
12. No control over outside influence
13. Effort consuming to produce the plan
14. Priorities might be wrong
15. Lack of flexibility to adjust/not responsive
16. Keeping it 'living document' is hard
17. Loses credibility if not adhered - how to ensure adherence
18. Complexity of it
19. Pain-in-the-ass
20. Time consuming
21. Arbitrary government cuts after BP approval
22. Long time cycle
23. R&D may not get financed

Business Planning: Gut feeling

1. Useless without long term government commitment
2. Absolutely essential to survival of R&D projects

3. It is essential for the fulfilment of the CF requirements
4. Keep it simple, keep it focused
5. Must be tied to doctrine and force development
6. Need for DND to market abilities - marketing strategy brings us back into the limelight
7. Necessary evil, potential to bog down
8. Keep it short and to the point
9. People should read it

CONCEPT B: TEAMING

Idea Base:

1. DREA model (co-location, integration).
2. Integrate whole process (Testing & Evaluation, engineering, team, doctrine, requirements capture, final delivery).
3. Near-term/long-term goals.
8. Integrate R&D with requirements.
9. Multi-disciplinary teams.
10. Common environment (engineering, research, operators, exercise).
12. Cross-pollination across services, countries.
14. Co-ordinate R&D with allies.
15. Capture client feedback.
21. Build stakeholder ownership of process.
22. Early industry involvement.
26. Scientist on military conferences/courses.
27. Military on scientific conferences/courses.
28. Role for universities/centres of excellence.
29. Military in labs.
31. Battle labs.
35. Military postgrads to scientific positions (R&D).
36. International exchange scientist/military.
38. Project life cycle posting.
42. Cost sharing with industry (leveraging/alliances/ partnering).
43. "Have a beer together".

Teaming: Information needs

1. Best team composition
2. What teams currently exist
3. Logistical constraints to learning
4. How much will department invest to make effective
5. Present state

6. Goals?
7. Location of team members
8. Location of team w.r.t. client
9. Needed expertise
10. Other's expertise
11. Required expertise
12. Strengths and weaknesses
13. Objective/project

Teaming: Creative solutions

1. Dedicated team for large projects
2. Video conferencing
3. Co-location of labs with users
4. Scientists spending time in the military environment
5. Better communication daily
6. Internet
7. Requirement/research/T&E/engineering/fielding
8. Retreats (beer together)
9. Old boy's network
10. Separate funding
11. Travel funds
12. Cost recovery
13. Marketing
14. Education
15. Industry acknowledgement of DND
16. Re-use of ideas
17. Fresh ideas through member rotation

Teaming: Benefits

1. Reduced cost
2. Improved productivity
3. Reduced risk
4. Improved cost effectiveness
5. Better product
6. Promotes idea generation and evaluation
7. Integrated approach/synergism
8. The solution
9. Sure to capture the requirement and to deliver the right product
10. Improves understanding and co-operation
11. Improves re-use
12. Establishes wider working networks

13. Promotes brainstorming and creative solutions
14. Reduces tunnel vision
15. Broadens knowledge and resource base
16. Fun
17. Better use of resources and infrastructure
18. Minimize duplication
19. Improves morale
20. Informal accountability
21. Innovation
22. Break culture barriers
23. Sharing of key information
24. Morale boost
25. Feeling of empowerment/ownership
26. Better use resources/ideas
27. Better direction
28. Increase value added
29. Build confidence

Teaming: Problems

1. Dominating personalities can hijack
2. Researchers are inherently loners
3. Good ideas can be compromised
4. Expensive
5. Time consuming
6. Team only as strong as weakest link
7. Incompatible interests
8. Personalities/politics
9. Distance/geography/travel costs
10. Conceptual conflicts (no agreement)
11. Consensus can give bad solutions
12. Co-ordination
13. Weak leadership
14. Lack or conflict of commitment
15. Poor communication/team dynamics
16. Can be counter-innovative (personalities)
17. Condescending
18. People aren't used to it
19. Clash of personalities limits effectiveness
20. May slow down creative work
21. Team size can be too big/wrong
22. Individual members may not be committed
23. Harder to control

Teaming: Problems Teaming: Gut feeling

24. Has value added
25. Must not slow down progress
26. Must do
27. Essential ingredient for success
28. Essential
29. Nice idea, this is an 'in' concept; how well has it worked? Are there areas where teaming for its own sake fails badly?
30. Works well but depends on individuals
31. Need good communications (i.e. Internet)
32. Need good leadership
33. Networking - understanding ops/scientists/industry - opens doors
34. Needed to make best use of lim ed resources

CONCEPT C: SHARING/LEVERAGING/SYNERGISM

Idea Base:

1. DREA model (co-location, integration).
2. Integrate whole process (Testing & Evaluation, engineering, team, doctrine, requirements capture, final delivery).
9. Multi-disciplinary teams.
12. Cross-pollination across services, countries.
13. Reduce code duplication (modularity).
14. Co-ordinate R&D with allies.
18. Common user core.
22. Early industry involvement.
25. Stimulate competitive R&D.
31. Battle labs.
32. Allocate resources to small/medium/long term research and problem resolution.
33. Maintain techbase capability/continuity.
36. International exchange scientist/military.
40. Target/select C2 R&D.
42. Cost sharing with industry (leveraging/alliances/ partnering).
45. Open requirements to industry

Sharing/...: Information needs

1. Knowledge of other's activities, expertise (allies, industry, university)
2. Knowledge of the CF needs, requirements
3. Knowledge of present state and future trends in technology
4. Knowledge of the R&D&T&E structure inside/outside

5. Communication links
6. International agreements
7. Industrial forces alliances
8. Are other nations interested?
9. Intellectual property ownership
10. Our strengths
11. Limited Canadian industry

Sharing/...: Creative solutions

1. Question NATO participation/TTCP/bilateral
2. Pursue MOU/ideas, etc.
3. Participate in university centres of excellence program
4. Market our technology
5. Go into production with our technology
6. Multi-establishment/disciplinary team
7. Creative financing
8. Distributed test beds
9. Internet solutions
10. Joint projects and support (SHAPE Technical Centre)
11. Royalties and patents
12. Imposing on contractors re-use of CUC and R&D lesson learned
13. Government seed money for basic research
14. Joint EX participation
15. Home pages access to information by all
16. Library of modules available for sharing
17. Regular sharing of status of research

Sharing/...: Benefits

1. Reuse code/systems
2. Lessons learned and shared
3. Less cost
4. Collaborative financing
5. Win-win situations
6. Promote Canadian industry
7. Technology transfer
8. Output greater than input
9. Avoid duplication of effort
10. Gain insight to others' long term goals
11. Spin-offs
12. Global approach, integrating all stakeholders towards the development of an accepted solution

13. Better focus of resources (optimal use of scarce resources)
14. Joint R&D
15. Re-use of experience, technology, solutions, ...
16. Fosters interoperability
17. Political alliances
18. Broaden networks
19. Maintain currency and leadership (Canadian influences)
20. Promote Canadian industry (and protects)

Sharing/...: Problems

1. Very bureaucratic (e.g. NATO WG)
2. Theft of information/knowledge (intellectual property)
3. Unequal sharing
4. Can't control the partner always
5. Partners may be at different stages
6. Different goals
7. Hidden agendas
8. Incompatible standards
9. Loss of IP ownership
10. Industry not well disposed to sharing (inherently competitive)
11. Potential for significant losses
12. Conflicting interest
13. Time consuming
14. Marketing problem
15. Who pays, who profits; what's the share
16. Dependence on allies
17. Slow CF buy-in at the end of the program
18. Poor/restricted technology transfer

Sharing/...: Gut feeling

1. It is a must
2. Only way to go - we have no choice
3. Essential
4. Must be mandated
5. Need formalization
6. Agreements in principle to standards and interoperability - yet slow to implement
7. Need to do this due to lack of resources
8. Do it but not the NATO working groups
9. Resources must be assigned up front to this
10. Worth the effort

11. Essential in environment of downsizing and budget constraint

CONCEPT D: SUPPORT SERVICES/ FACILITIES

Idea Base:

1. DREA model (co-location, integration).
2. Integrate whole process (Testing & Evaluation, engineering, team, doctrine, requirements capture, final delivery).
5. Ensure SM commitment.
10. Common environment (engineering, research, operators, exercise).
13. Reduce code duplication (modularity).
16. Rapid prototyping in phases.
17. Evolutionary spiral development model.
18. Common user core.
30. Focus on the future.
31. Battle labs.
33. Maintain techbase capability/continuity.
34. Protect government expertise (with respect to downsizing).
35. Military postgrads to scientific positions (R&D).
37. Test/evaluate in LIVEX.
42. Cost sharing with industry (leveraging/alliances/ partnering).

Support Services: Information needs

1. How much is spent today?
2. How many facilities, requirements
3. Cost/consequences of consolidation
4. Requirements to support
5. Determine best locale for support facilities to be provided
6. Define/ensure adequate resources (dollars/PY)
7. Establish and maintain common core
8. Repository of op. data
9. Define methodology
10. Define tools to support methodology
11. Define training requirements to maintain expertise

Support Services: Creative solutions

1. Teaming
2. Multi disciplinary team
3. Distributed battle lab
4. Integration from doctrine to delivery

5. Commitment (resources, dollars) from masters for the short- to long-term
6. Common tools and development repository
7. Provide mechanism for industry to special
8. Turn labs over to services
9. Exploit industry facilities
10. Pay for own facilities by renting out
11. Mobile labs/deployed battle labs
12. Virtual labs
13. Distributed development
14. Software libraries common

Support Services: Benefits

1. Faster better results
2. More open communications
3. Improved effectiveness
4. Flexibility
5. Cost effective
6. Greater availability of resources for experiments
7. Demonstration fosters user confidence in technology
8. In-house facilities and capability
9. Capability to rapidly respond to an urgency
10. Independent/unbiased advice to CF
11. Maintain independent expertise
12. More efficient support to R&D, T&E, and procurement
13. Improves support to R&D

Support Services: Problems

1. Costs resources
2. Can be localized
3. Can be restrictive
4. How do you co-locate with a very dispersed organization
5. Overhead
6. Cost to restructure/disruption to projects
7. Impact on operational facilities
8. Tendency to obsolescence
9. Lack of co-operation on shared facilities
10. They have their own priorities/objectives
11. Conflict of interest
12. Priority of the use
13. Veto?
14. Unavailable when needed

15. Bureaucratic procedure (delays, costs)

Support Services: Gut feeling

1. Closer to users would be good
2. Need infrastructure to support progress
3. A cost effective solution
4. Fundamental to R&D
5. We must have an integrated approach from the R&D to the fielding; thus we must have the facilities required for this approach
6. Co-ordination, sharing of resources, and long term infrastructuring funding is essential
7. Can provide cost savings
8. Must not be rigidly enforced
9. Cannot be burdened with tradition mil/std documentation requirements
10. Need for remote/local tech support as well - spread knowledge base

CONCEPT E: EXPERTISE/EDUCATION

Idea Base:

1. DREA model (co-location, integration).
12. Cross-pollination across services, countries.
13. Reduce code duplication (modularity).
19. Improved awareness/education in fielding prototypes.
23. Protect/capture knowledge base.
24. Post scientist in ops..
25. Stimulate competitive R&D.
27. Military on scientific conferences/courses.
28. Role for universities/centres of excellence.
29. Military in labs.
30. Focus on the future.
31. Battle labs.
32. Allocate resources to small/medium/long term research and problem resolution.
33. Maintain techbase capability/continuity.
34. Protect government expertise (with respect to downsizing).
35. Military postgrads to scientific positions (R&D).
36. International exchange scientist/military.
37. Test/evaluate in LIVEX.

Expertise: Information needs

1. Present state
2. Desired state
3. Resources available
4. State of the R&D, technologies of interest
5. Involvement in university
6. Technology trends
7. Inventory of own technology, expertise, personnel
8. Deficiencies and strengths for specific technologies
9. Training budget
10. Future vision define areas to target
11. How to do it
12. Allocate funds and resources

Expertise: Creative solutions

1. Exchange secondment to industry/sabbaticals for academia/cross pollination for military/civilian/allies
2. Integrated battle labs
3. Training labs (field and garrison)
4. Scientists to field exercises and military to labs
5. Wide use of Internet/multi-media tool/ sponsorship of post-grads/co-op students
6. Sponsor grads on DND project teams for masters
7. International exchanges
8. Regular conferences/symposiums mixed military/scientist
9. Enroll scientists in CF (35 year engagements!)
10. Cycle scientists between short term tasks and technology base
11. Lots of money for education
12. Get the operators in the lab and the scientists in the field
13. Involve students (military and civilian) early (ideas, energy, cheap!!)
14. Be aware of technology trends and requirements
15. Seminars and courses taught by scientists
16. Teaming with university

Expertise: Benefits

1. Forefront of the technology
2. Avoidance of re-inventing wheel
3. Not captive of contractor
4. Renewal of the organization, knowledge
5. Technology insertion much more rapid

6. Promotes morale
7. Ensure understanding of requirements, solutions, methods, ...
8. Prevents stagnation
9. Promote informed decision making
10. Better results
11. Faster transfer from academia/theory to application
12. Increased flexibility to adjust goals
13. Broader perspective
14. Minimize risk
15. Needed for effective R&D
16. Needed to provide advice to CF

Expertise: Problems

1. Become too specialized, too narrow, focused
2. Ramping up time
3. Loose the best industry
4. Academic competition (guarding of knowledge)
5. Elitism
6. Lose focus on real issue
7. Loss of productivity while building expertise
8. Building expertise in completely wrong direction
9. High cost of building expertise
10. Can't be experts in everything / limited by resources
11. Needs to be tempered with experience
12. Slow response time (out-of-phase with requirements and trends)
13. Poor adaptability (resistance to changes)

Expertise: Gut feeling

1. Needed desperately
2. No money or resources
3. More cuts to come
4. Industry thinks of DND as 'cash cow'
5. Key to effectiveness of program
6. Long overdue
7. Remove barriers
8. Need departmental commitment
9. Motherhood
10. Absolutely essential
11. This is a must to keep abreast with the technology and to bring the technology into the CF

12. Must be planned - and based on best available prediction of future trends and need

PRIORITIZATION

VOTING SUMMARY

	P1	P2	P3	P4	P5	P6	P7	P8
A. Business Planning/Delivery Strategy	1	3	2	1	4	2	2	4
B. Teaming	2	4	3	4	1	1	1	1
C. Sharing/Leveraging/Synergism	2	1	4	5	3	4	4	2
D. Support Services/ Facilities	2	5	5	3	2	5	5	5
E. Expertise/ Education	2	2	1	2	5	3	3	3

AVERAGE RANK

	Average Rank
A. Business Planning/Delivery Strategy	2.4
B. Teaming	2.1
C. Sharing/Leveraging/Synergism	3.1
D. Support Services/ Facilities	4.0
E. Expertise/ Education	2.6

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On 7-9 May 1996, the Chief of Research and Development (CRAD) held a Workshop on Command and Control (C2) which brought together CRAD scientists and Canadian Forces (CF) Officers to discuss the "what" and the "how" of C2 Research and Development (R&D). The participants were divided into syndicates to discuss these issues using a structured brainstorming technique developed by the authors. This paper documents the results of the brainstorming exercise on the structures and processes (the "how") suggested for future C2 R&D. A companion paper is available on the requirements and opportunities (the "what") for C2 R&D for the foreseeable future.

There was a large amount of consensus on the main findings of this syndicate exercise which were that: a team culture must be established to provide the synergy necessary to exploit these new technologies quickly and effectively; the process of information dissemination and internal communication must be improved to enhance the capabilities of the teams; the future Battle Labs should be exploited to their fullest to provide an experimental environment for C2 R&D; and, the organization and structures will need to be improved to streamline the R&D process. Some other ideas were presented without full consensus, such as: the establishment of an evolutionary R&D and Procurement paradigm; the need for a new strategic direction in C2 R&D which should be developed by CRAD and CF leadership; and business planning and accountability which will improve the relationship between CRAD and its sponsors making the R&D process more responsive. The conclusion of this workshop was that the team approach to C2 R&D has begun and that there is much more work to do to exploit the many good ideas provided by the workshop attendees and documented in the Annexes to this paper.

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